

# **Appendix N**

## **Scanning Electron Microscopy Images (High UV and Low Ozone Chamber)**

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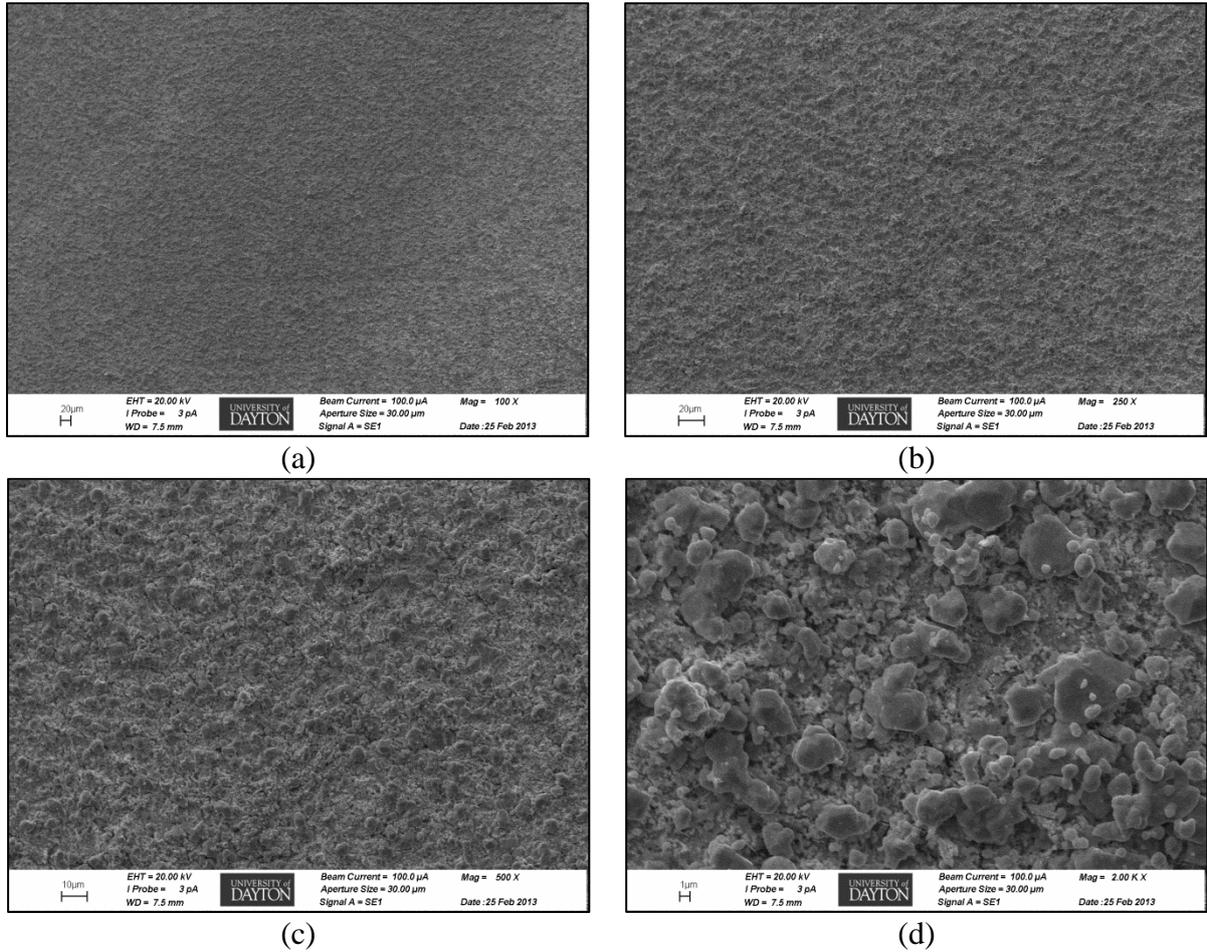


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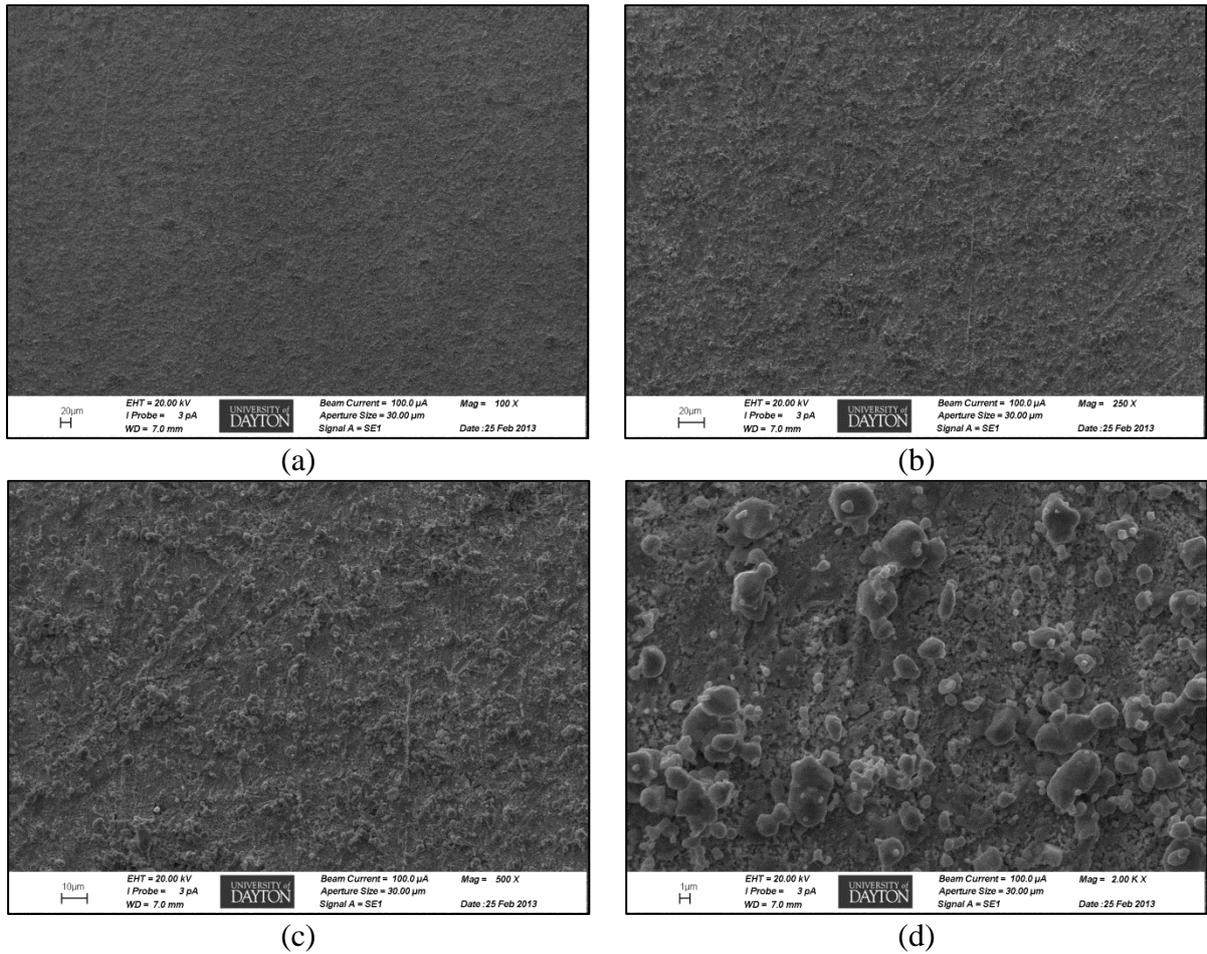


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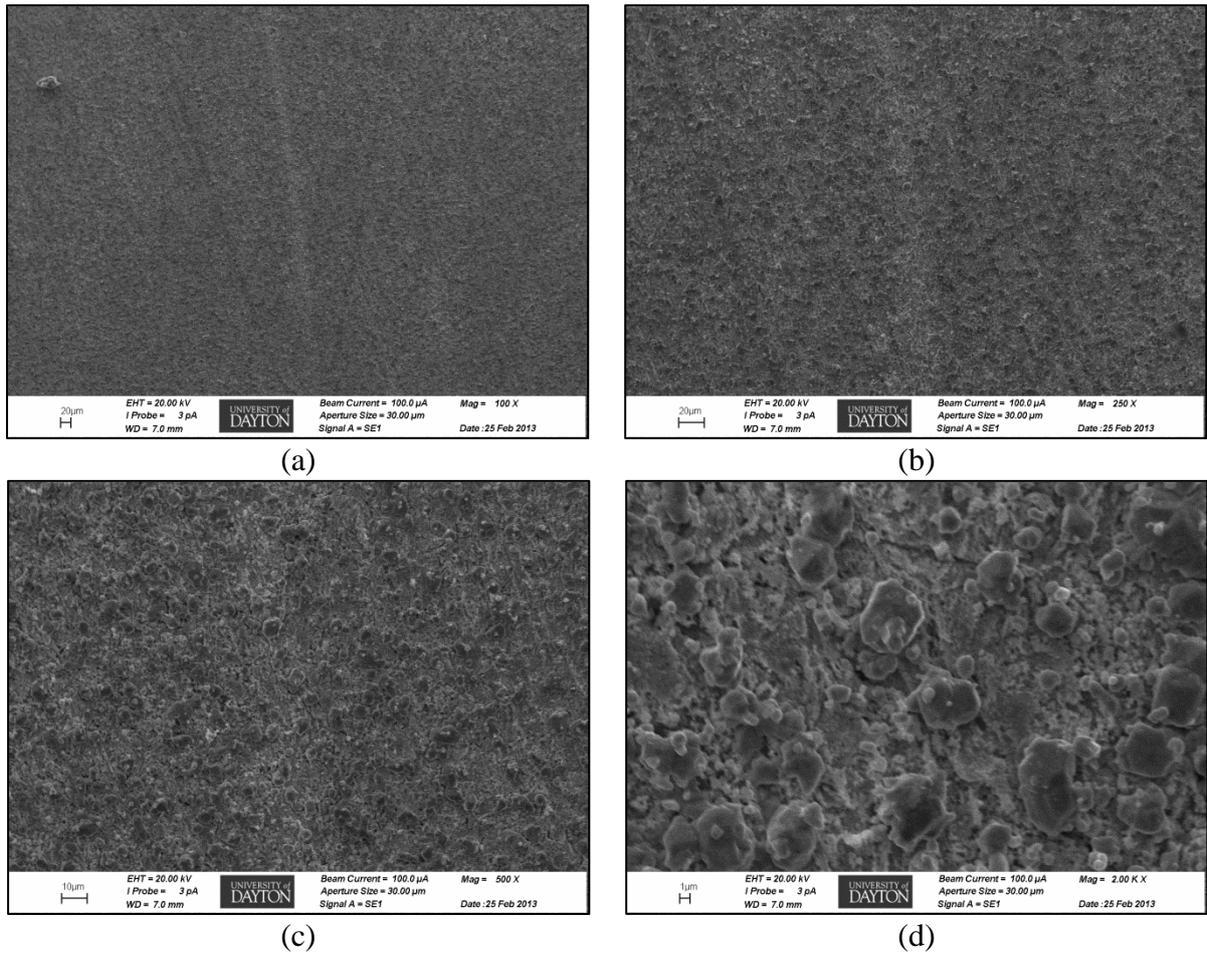
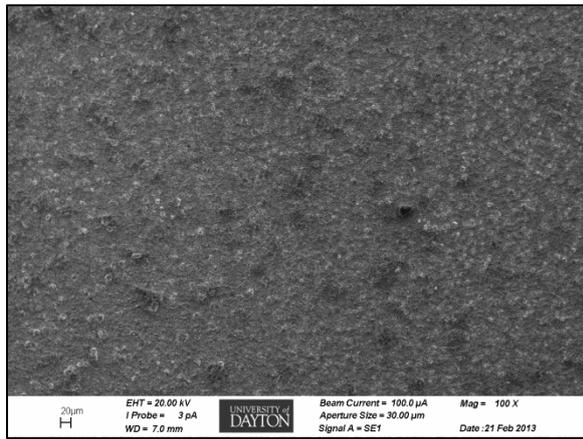
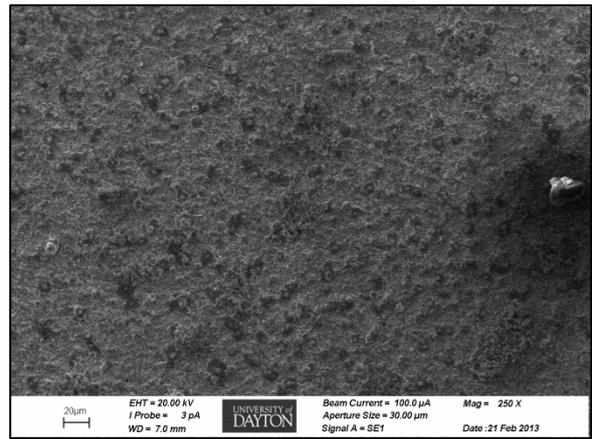


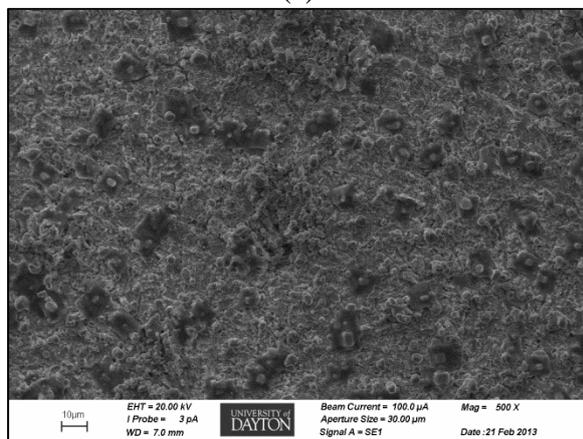
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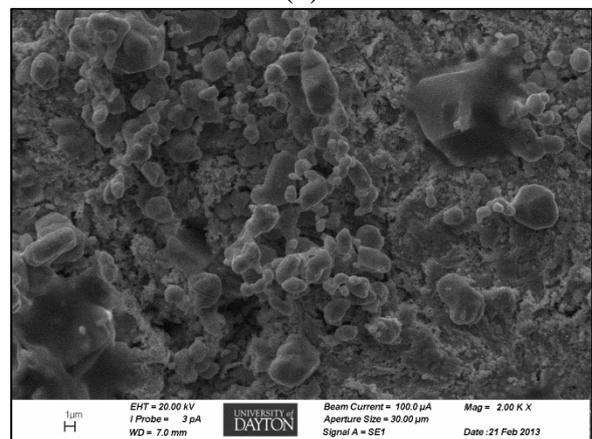
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(b)



(c)



(d)

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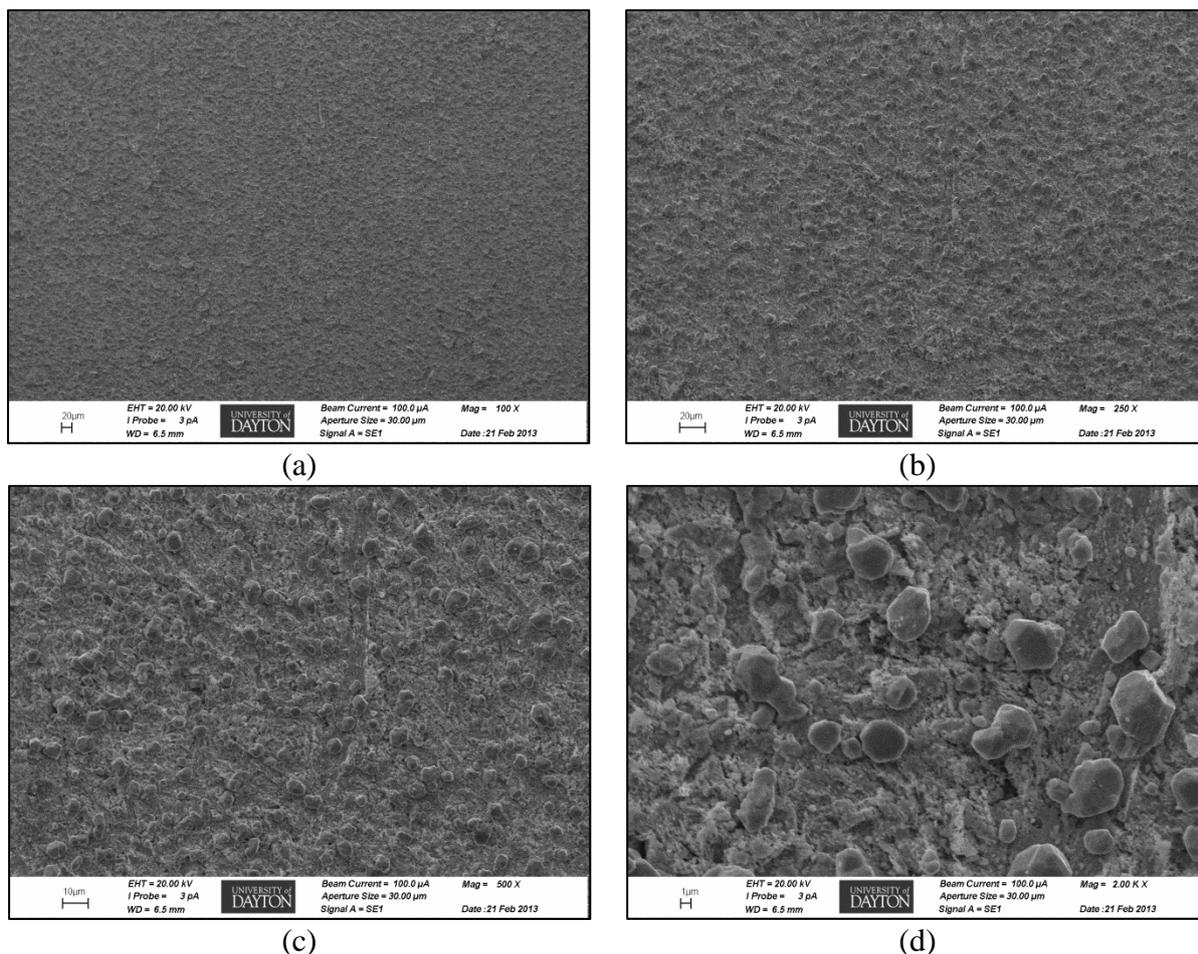
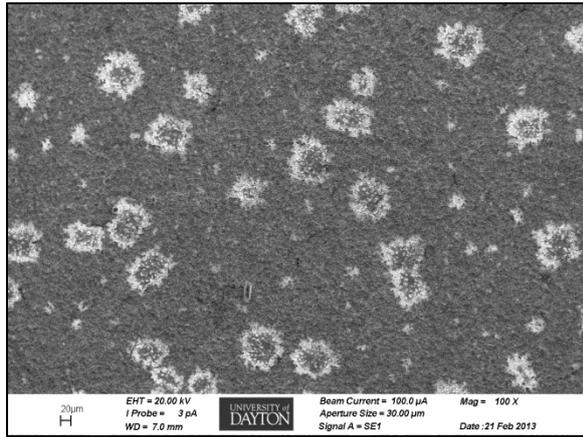
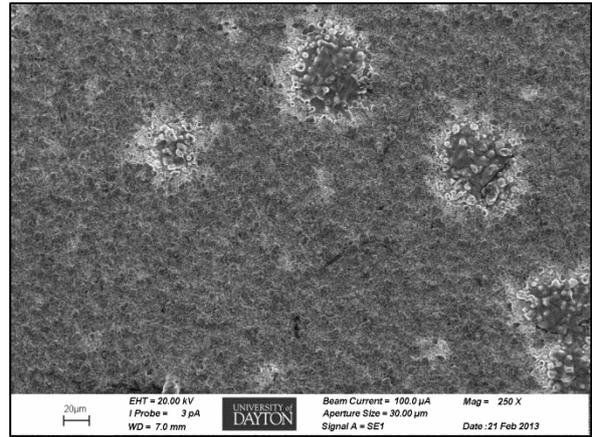


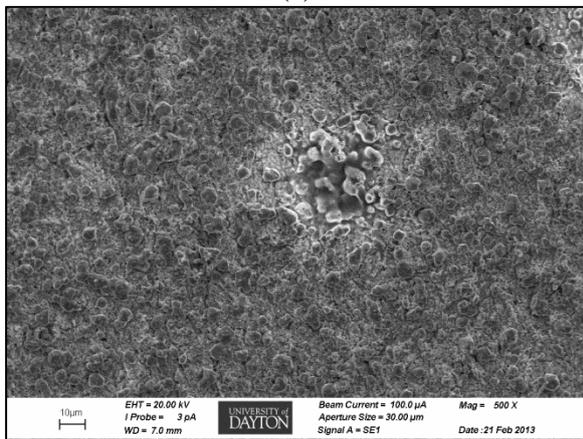
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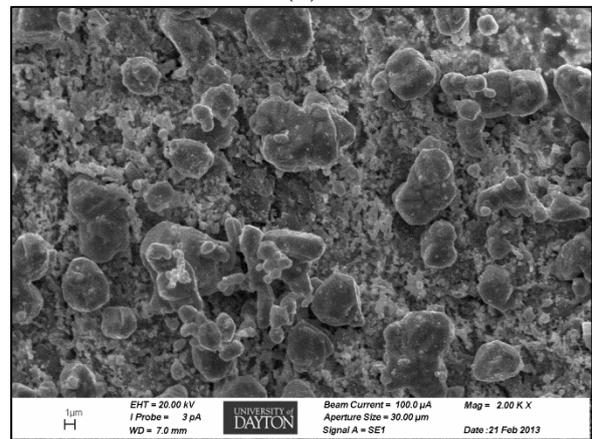
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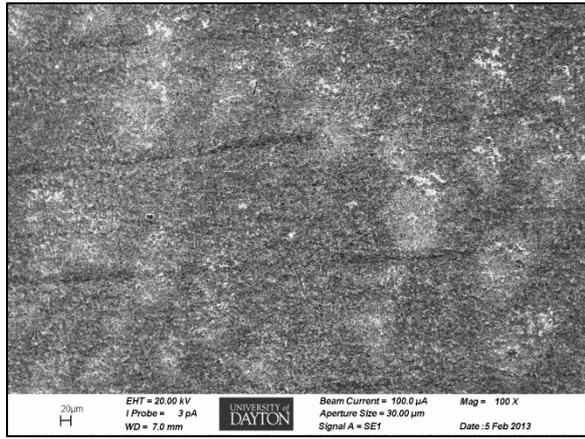


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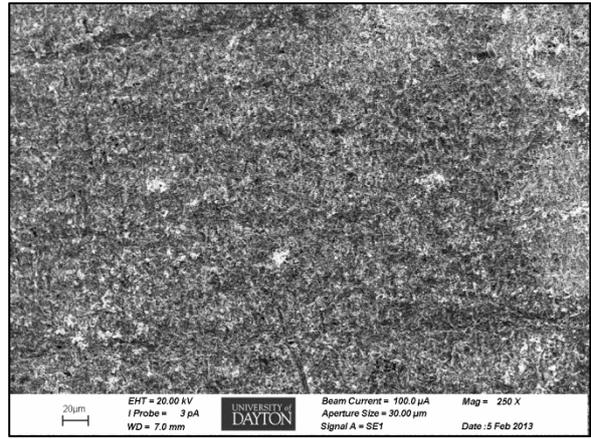


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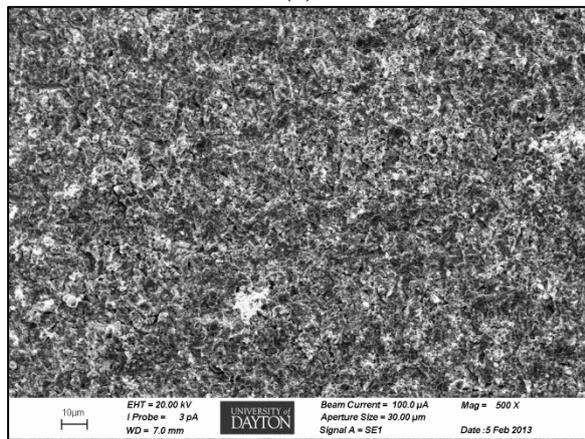
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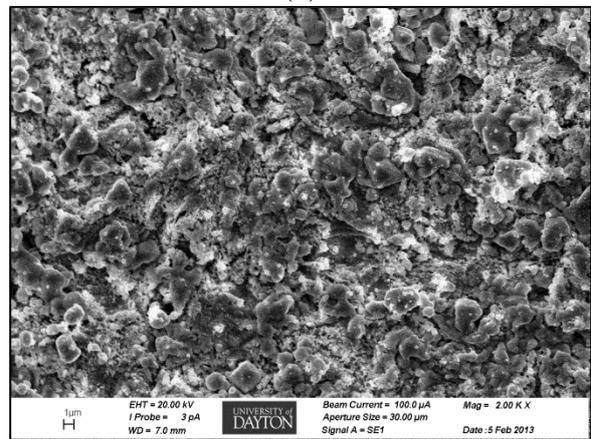
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(b)



(c)



(d)

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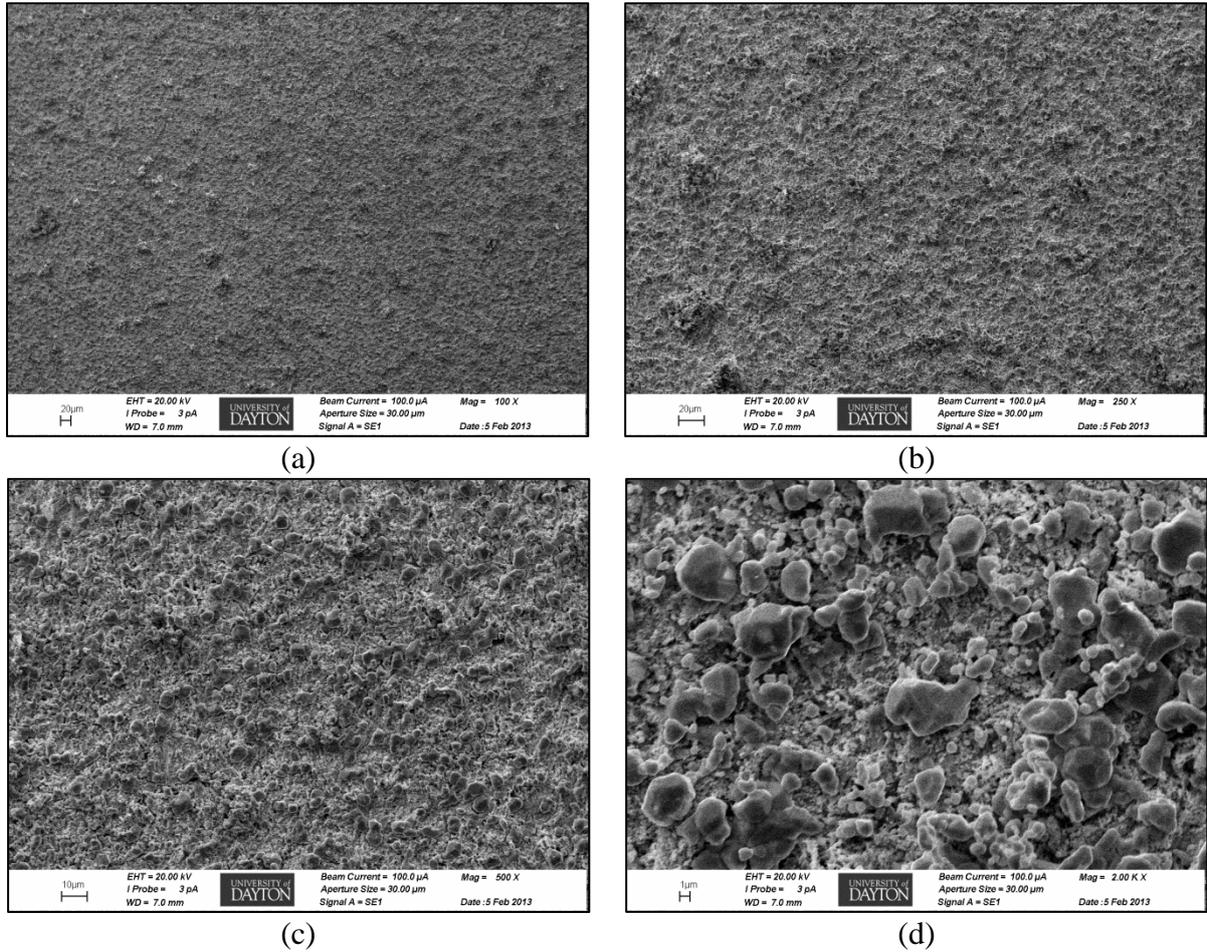
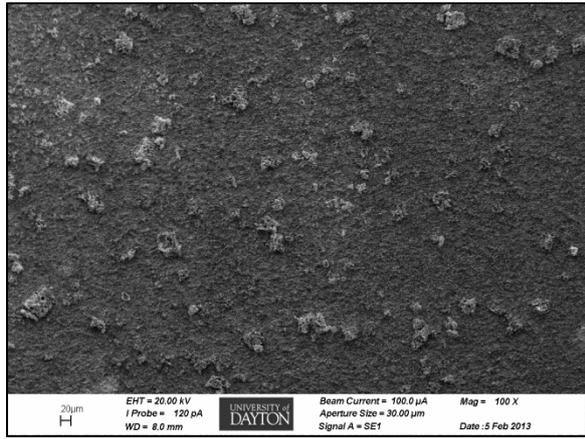
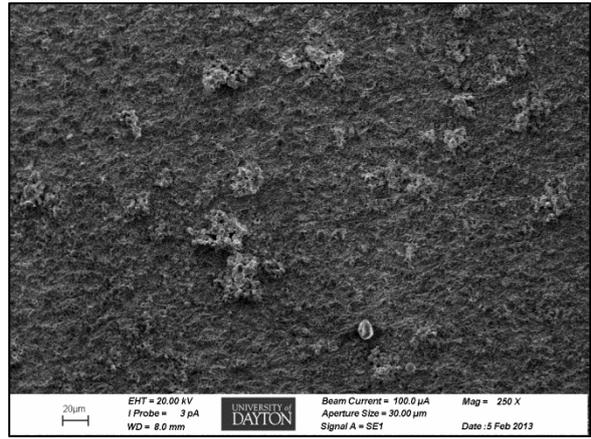


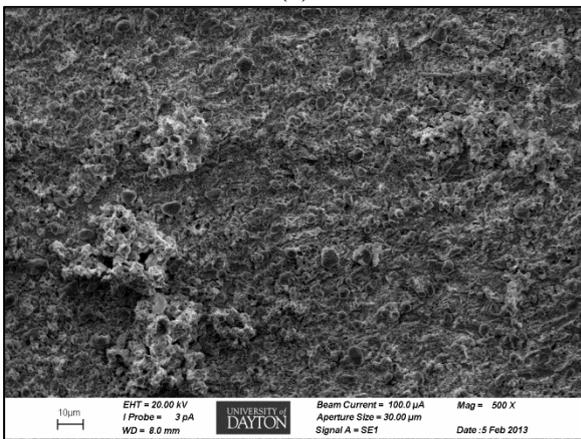
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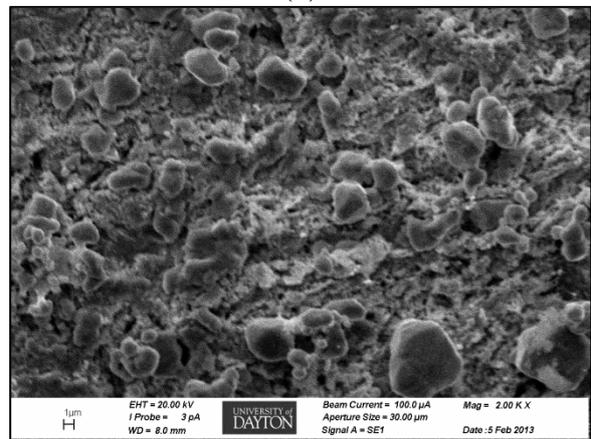
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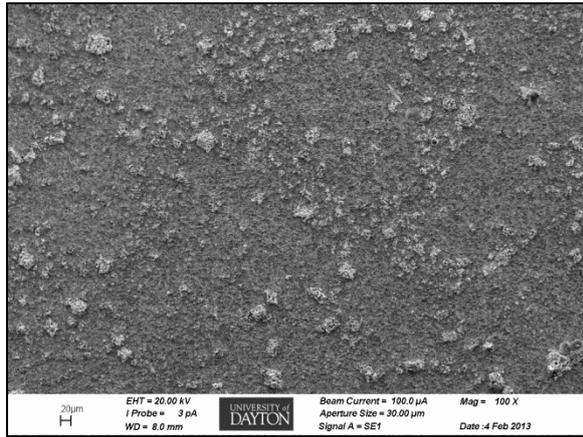


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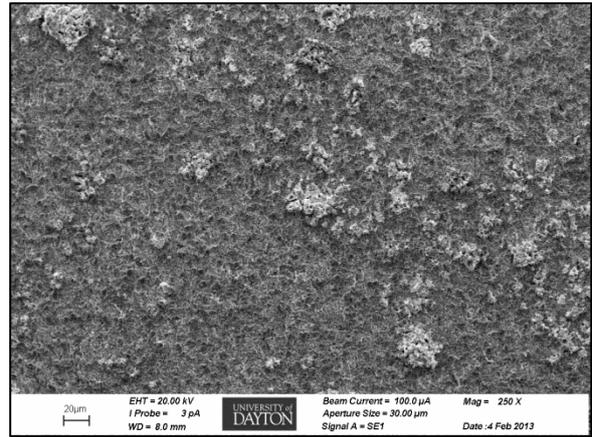


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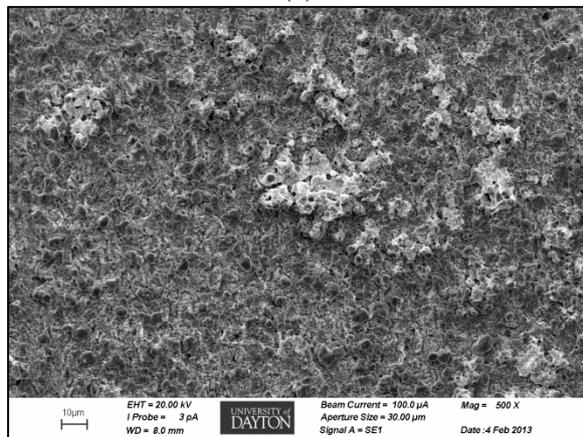
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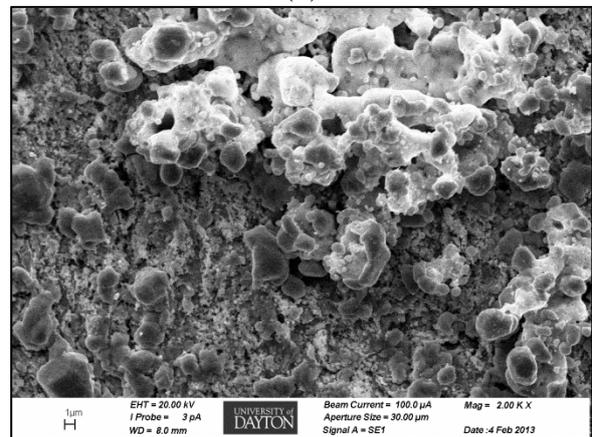
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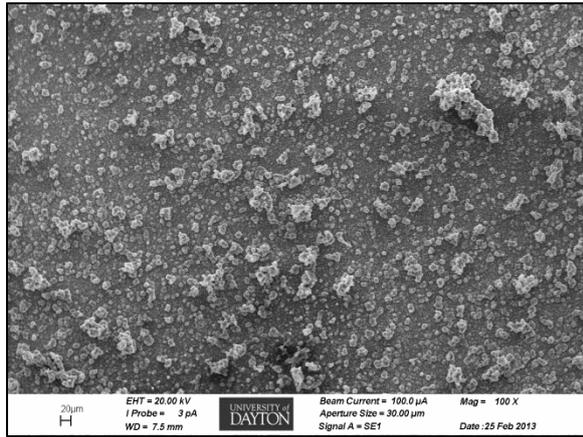


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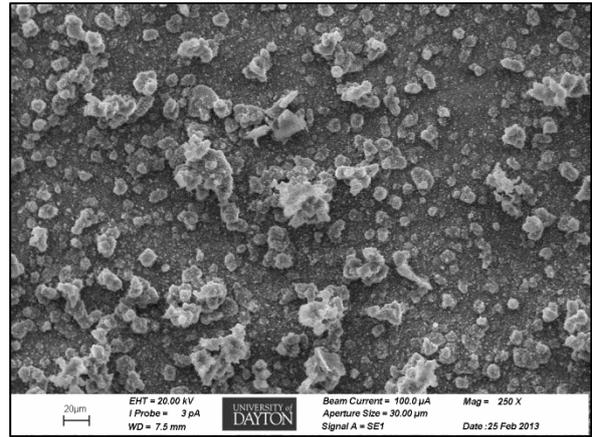


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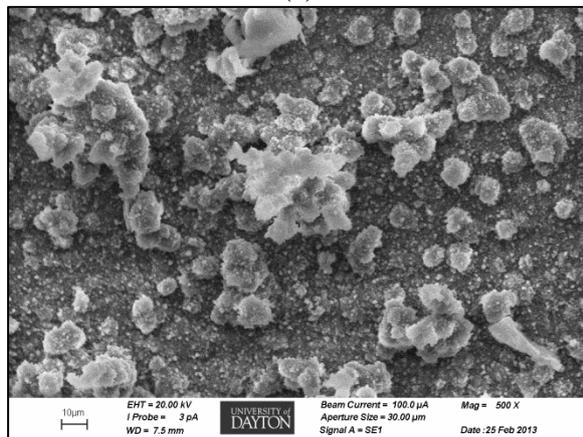
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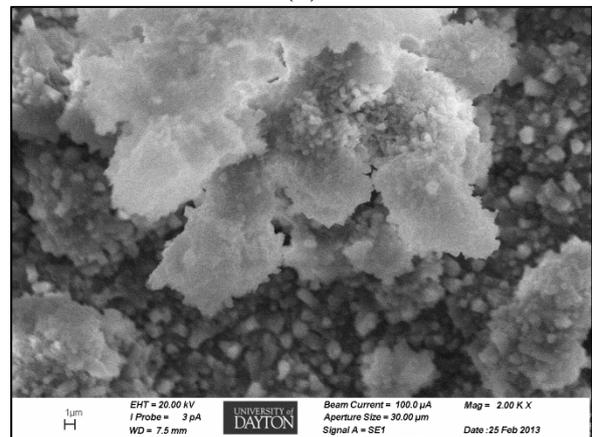
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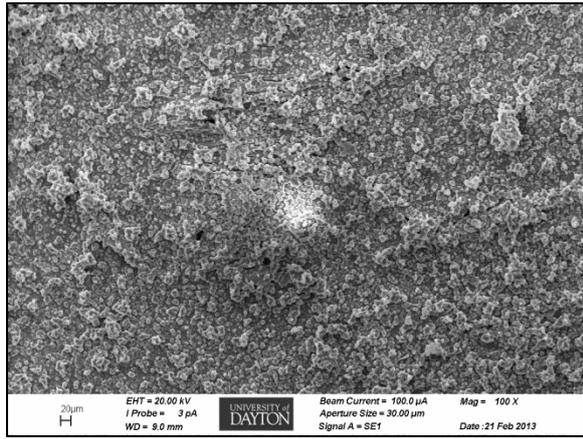


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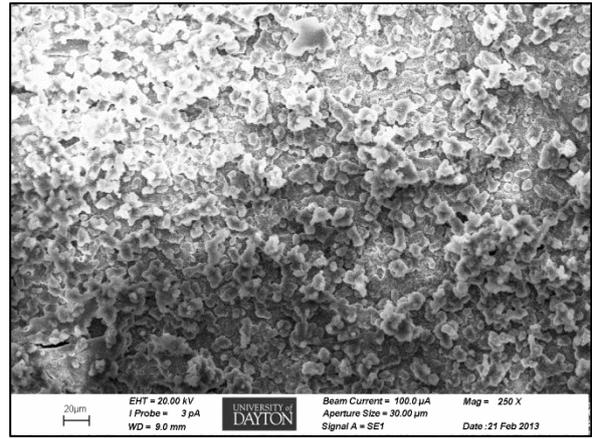


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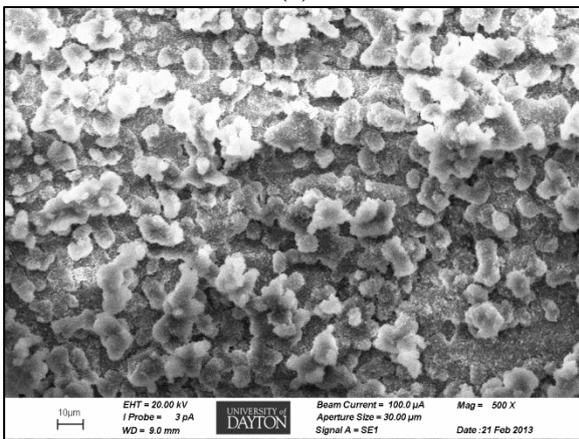
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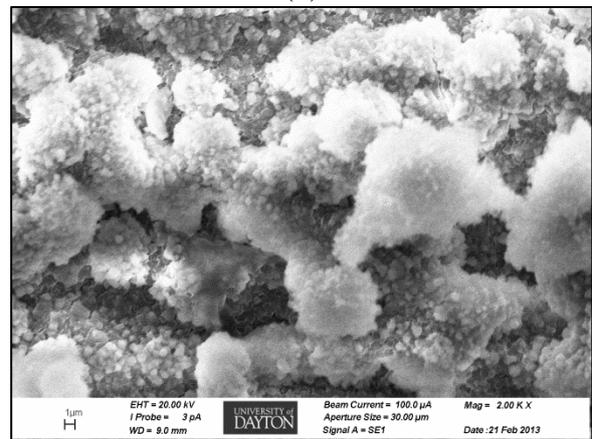
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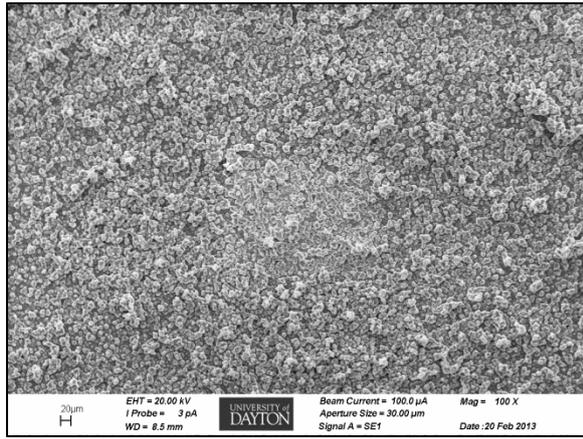


(c)

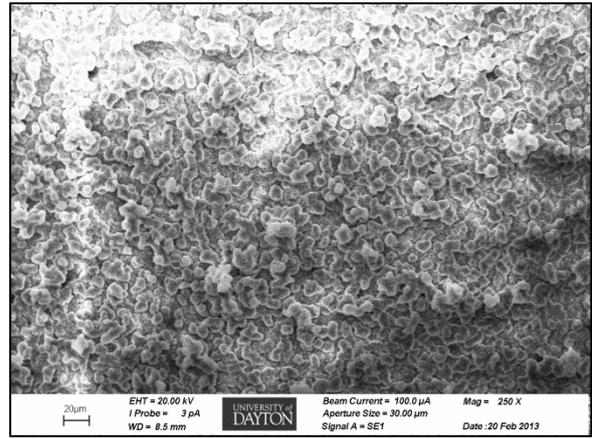


(d)

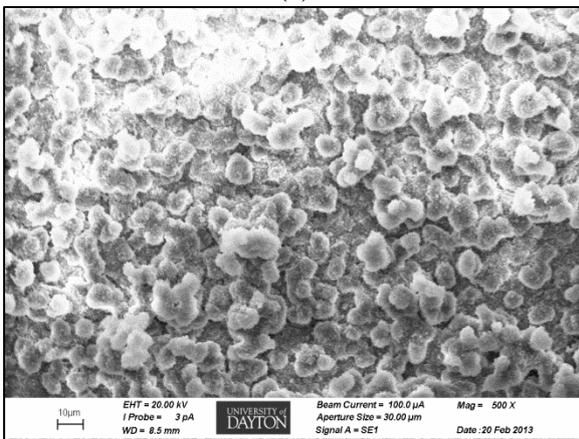
Figure N-12. SEM images of aluminum alloy 7075 sample retrieved on 900 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



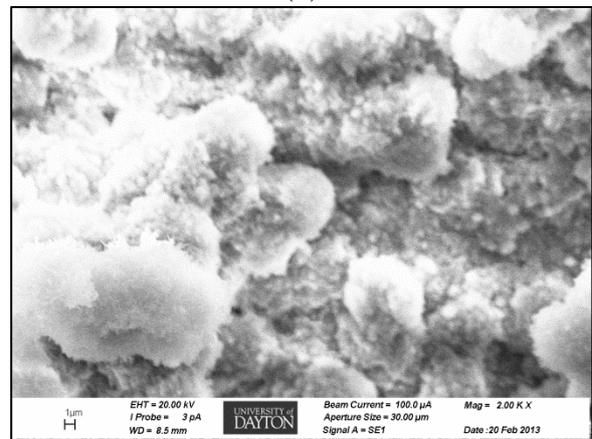
(a)



(b)

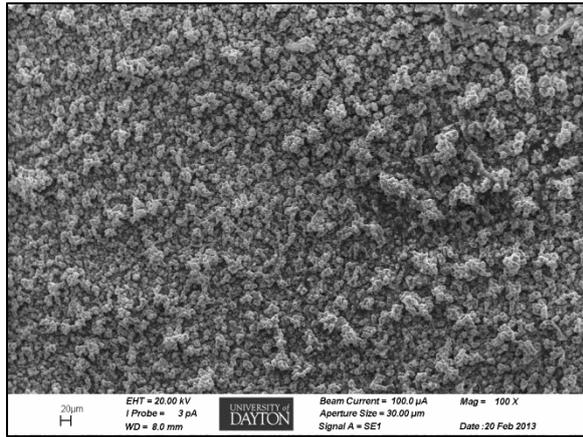


(c)

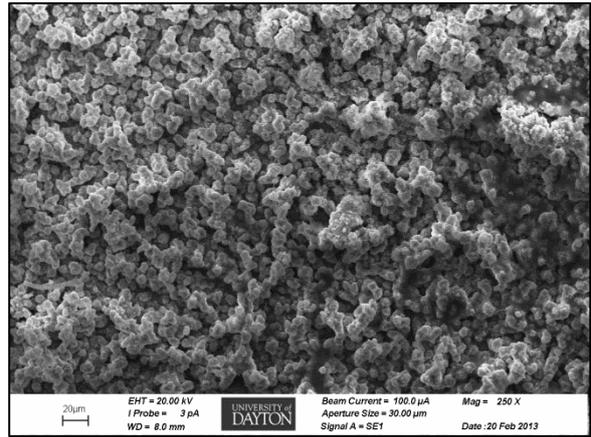


(d)

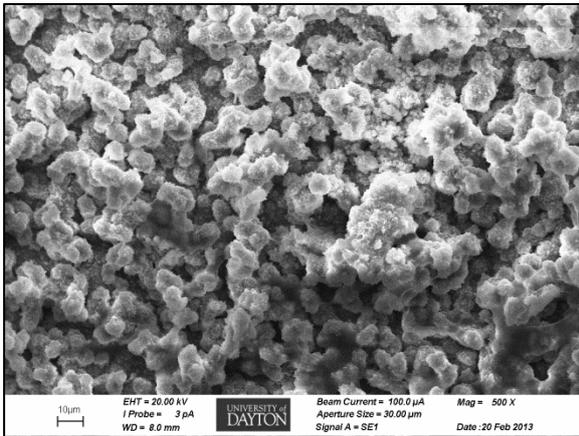
Figure N-13. SEM images of aluminum alloy 7075 sample retrieved on 800 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



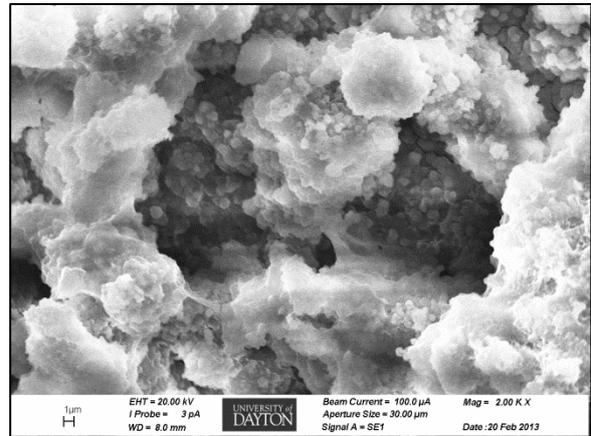
(a)



(b)

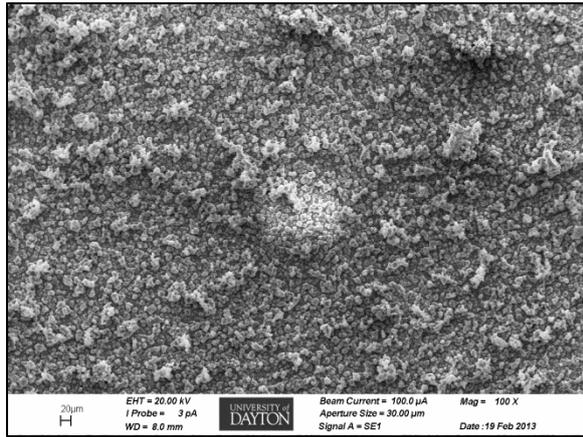


(c)

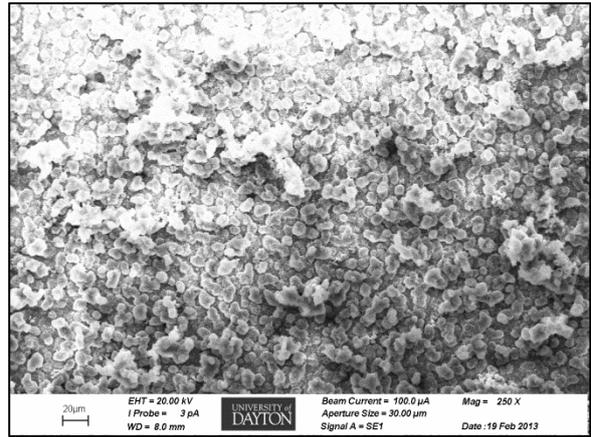


(d)

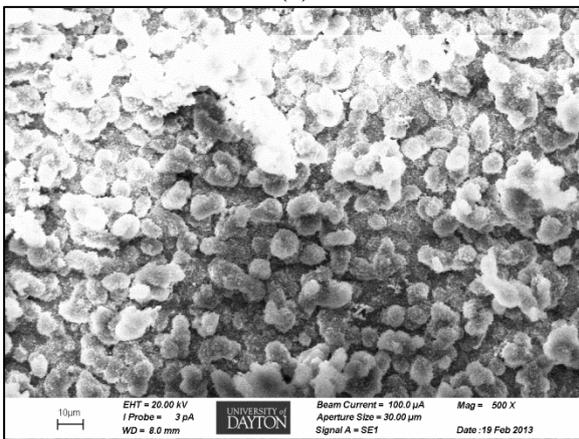
Figure N-14. SEM images of aluminum alloy 7075 sample retrieved on 700 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



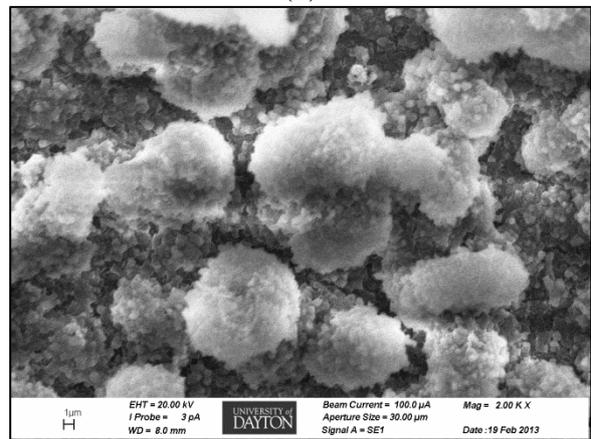
(a)



(b)

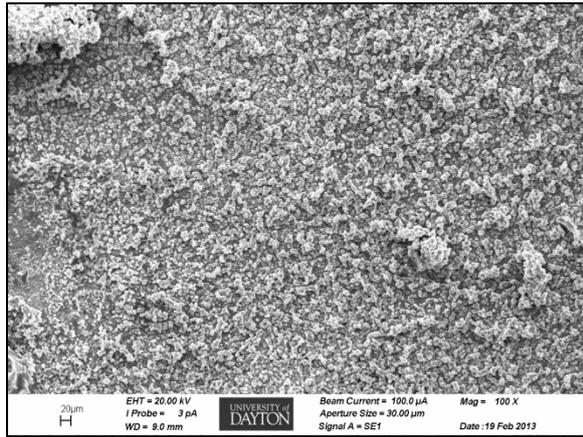


(c)

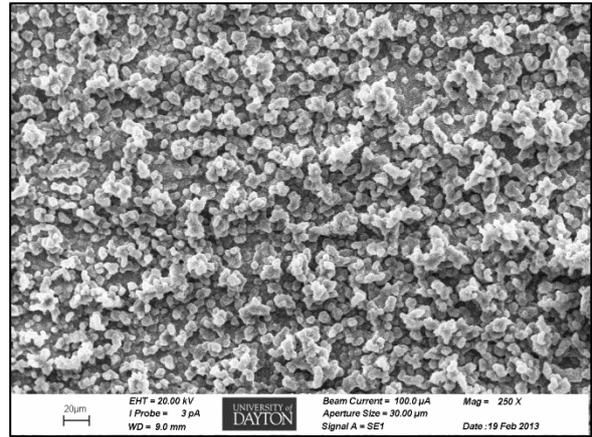


(d)

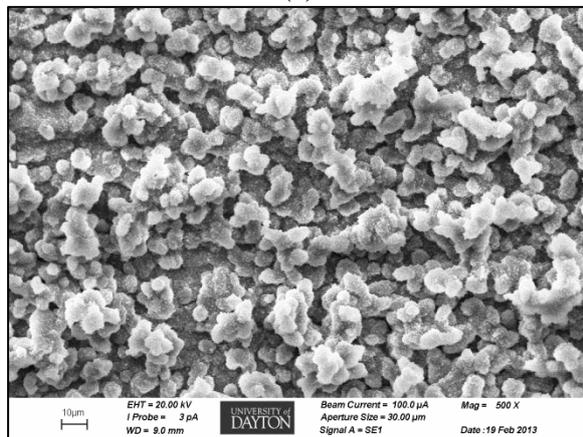
Figure N-15. SEM images of aluminum alloy 7075 sample retrieved on 600 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



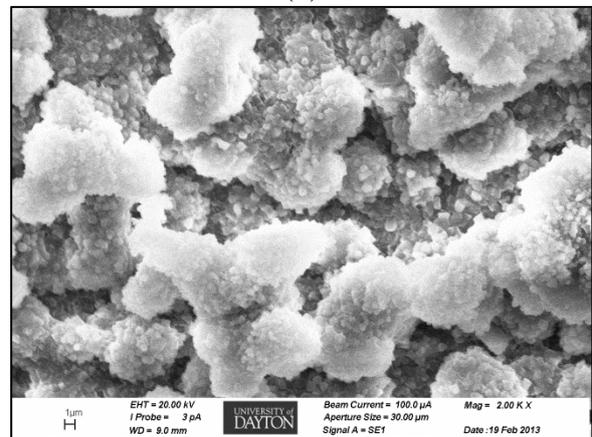
(a)



(b)

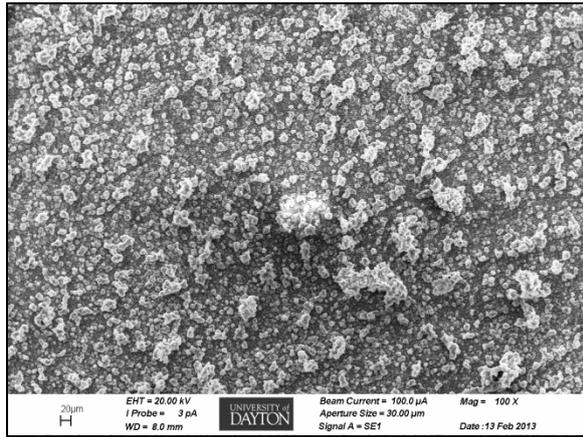


(c)

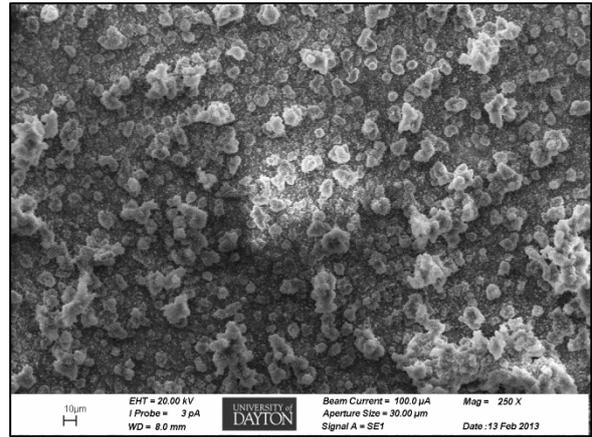


(d)

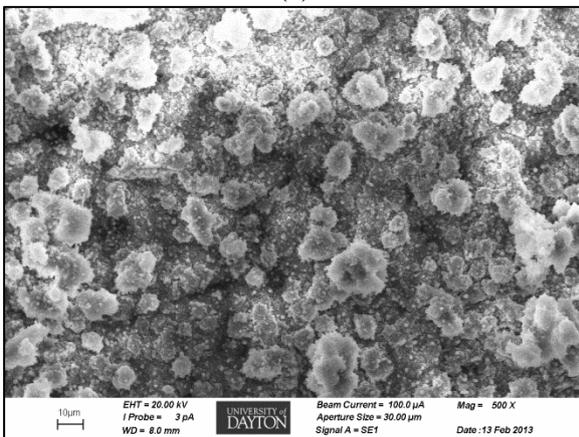
Figure N-16. SEM images of aluminum alloy 7075 sample retrieved on 500 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



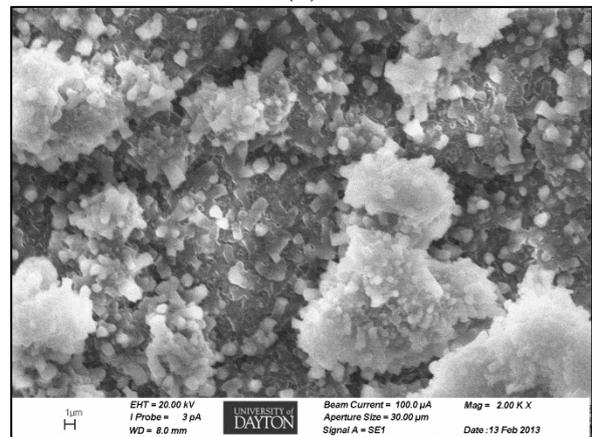
(a)



(b)

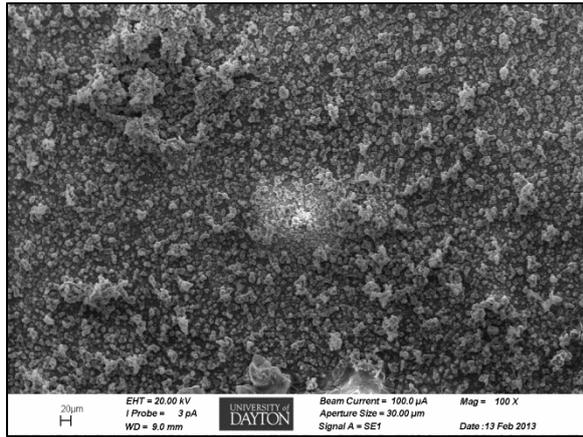


(c)

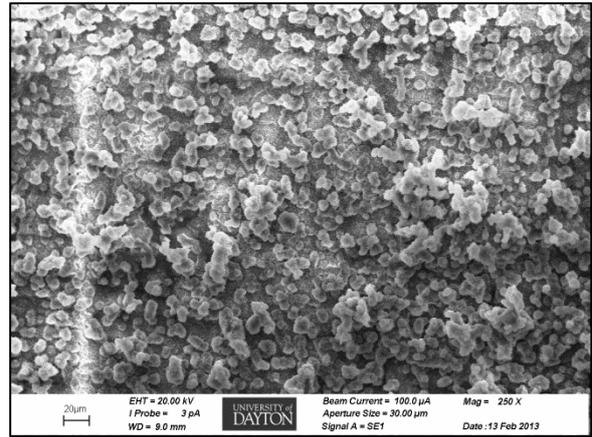


(d)

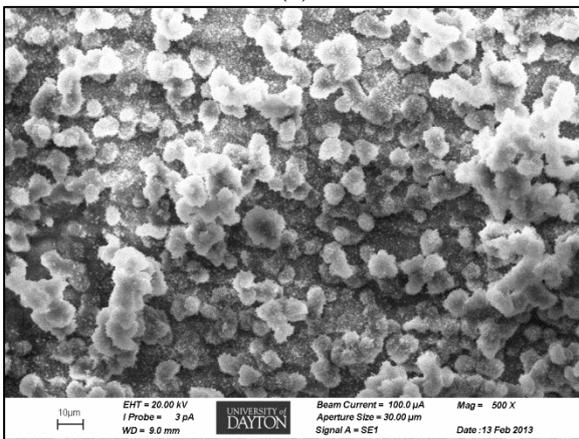
Figure N-17. SEM images of aluminum alloy 7075 sample retrieved on 400 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 100X magnification



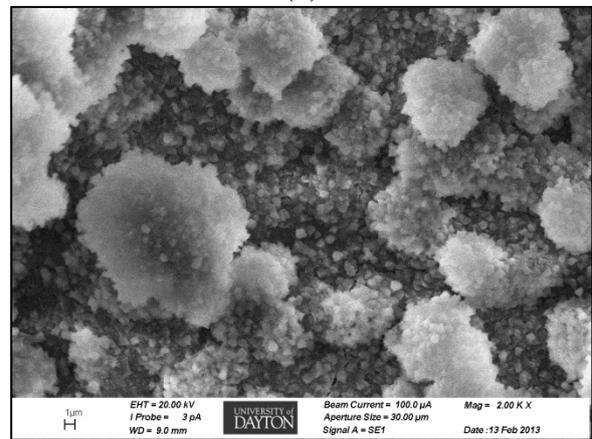
(a)



(b)

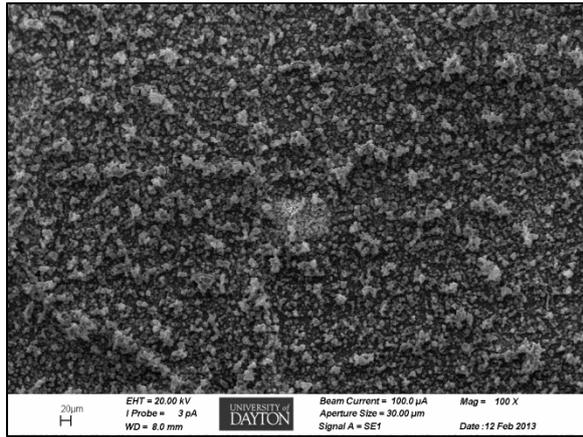


(c)

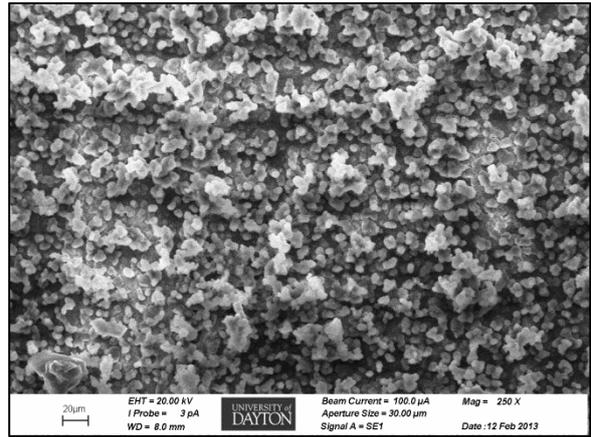


(d)

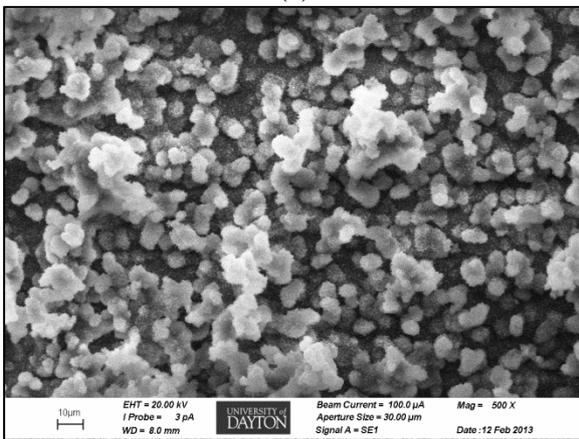
Figure N-18. SEM images of aluminum alloy 7075 sample retrieved on 300 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 1000X magnification.



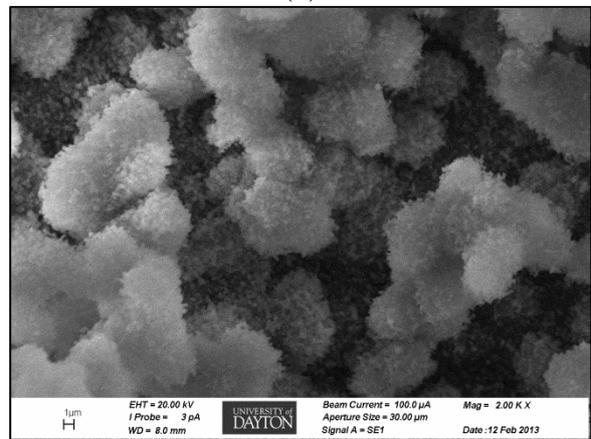
(a)



(b)

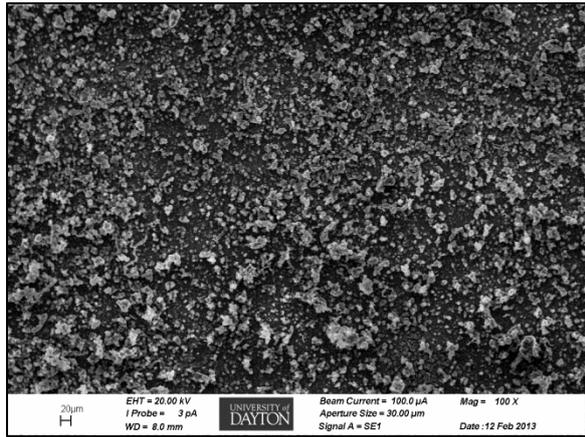


(c)

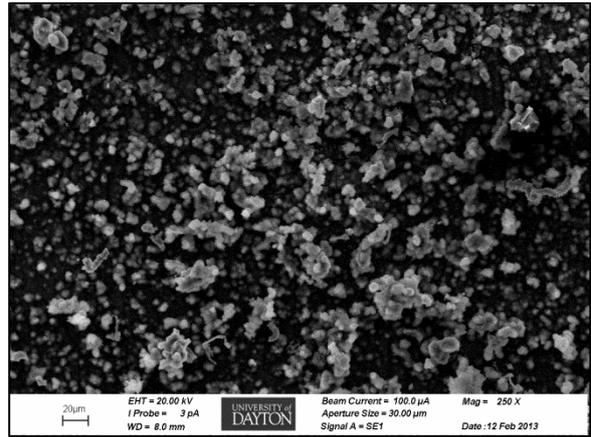


(d)

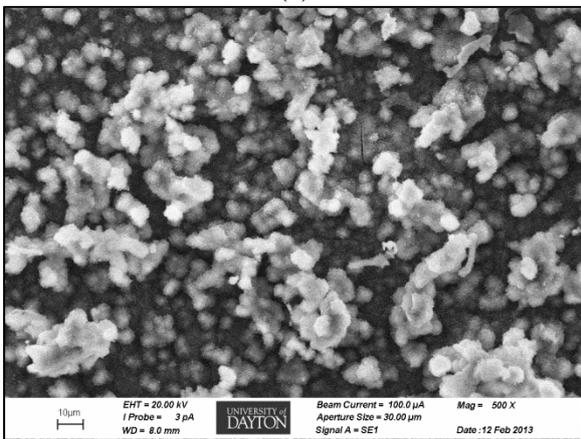
Figure N-19. SEM images of aluminum alloy 7075 sample retrieved on 200 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 2000X magnification



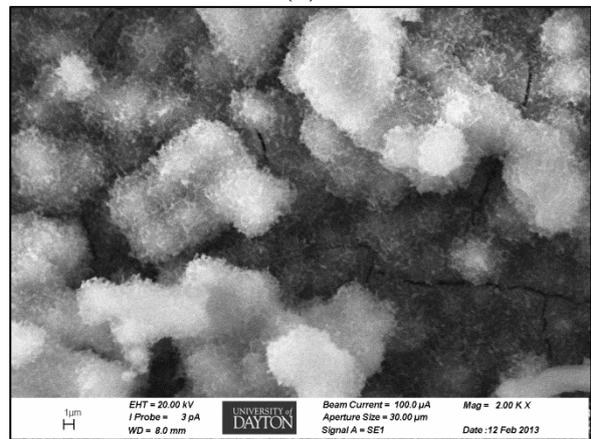
(a)



(b)

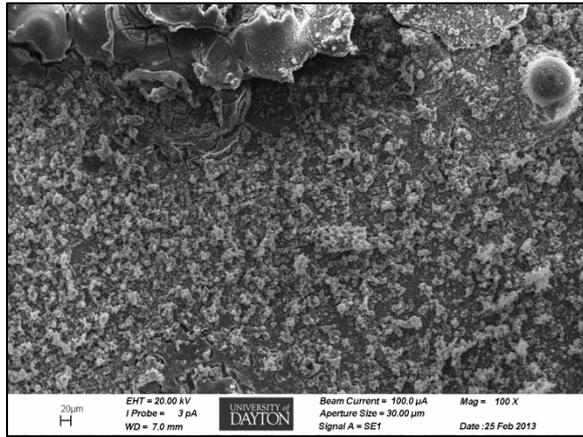


(c)

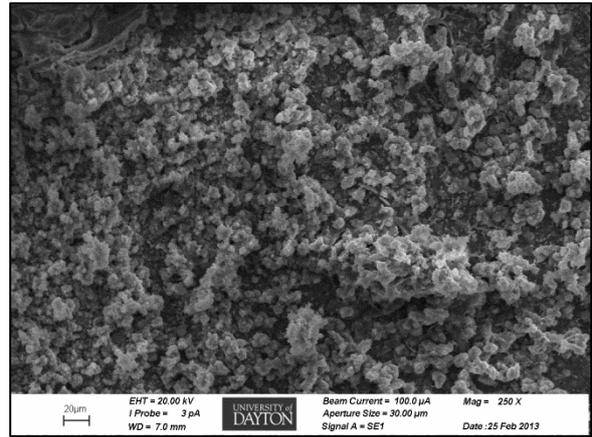


(d)

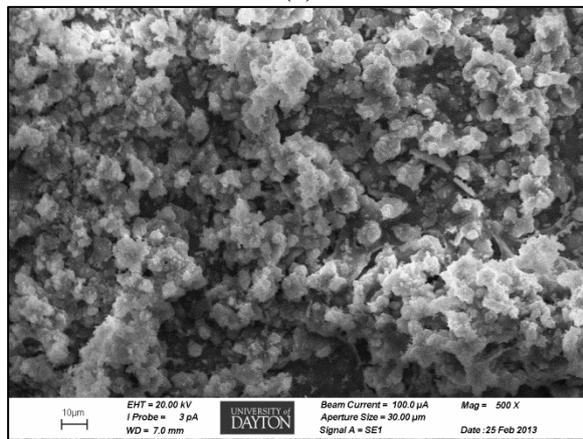
Figure N-20. SEM images of aluminum alloy 7075 sample retrieved on 100 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



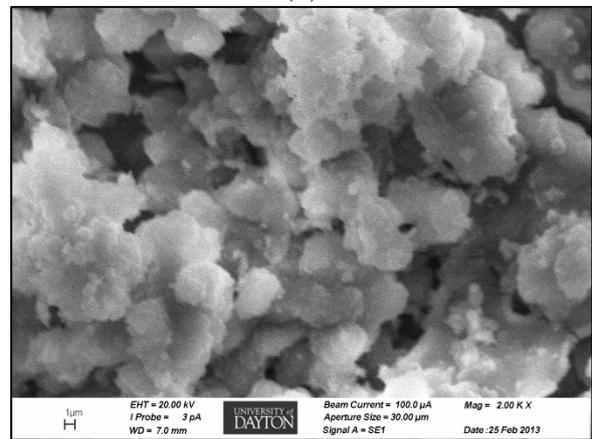
(a)



(b)

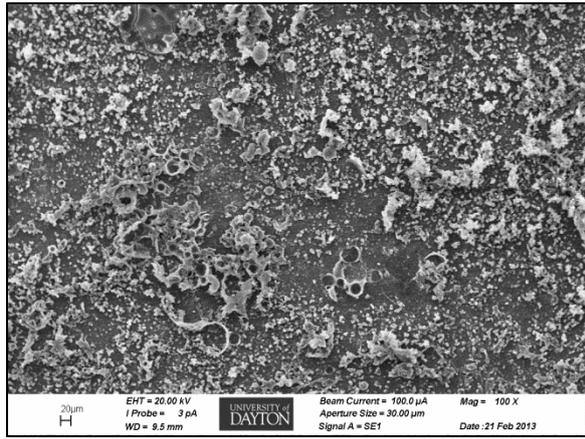


(c)

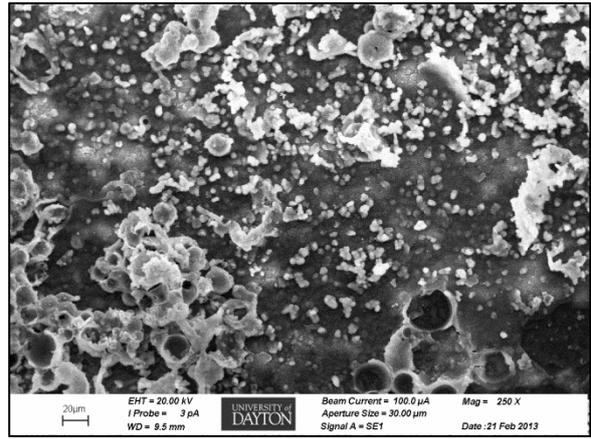


(d)

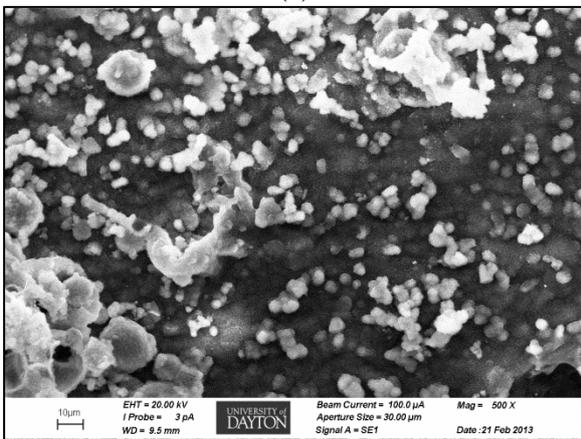
Figure N-21. SEM images of aluminum alloy 6061 sample retrieved on 1000 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



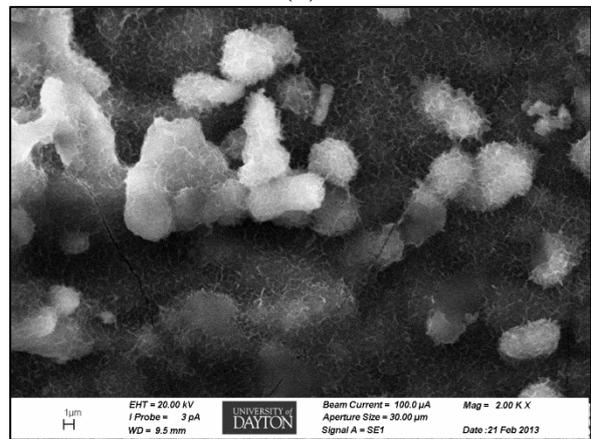
(a)



(b)

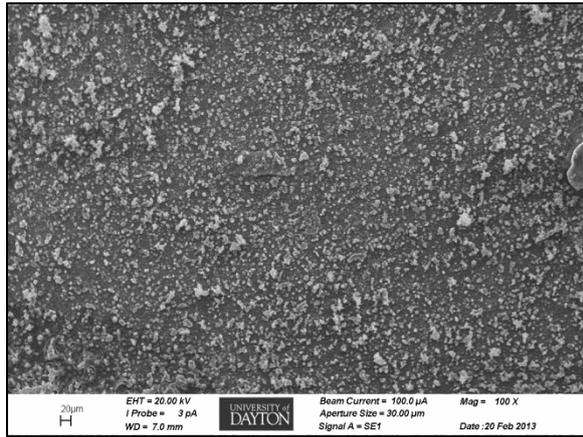


(c)

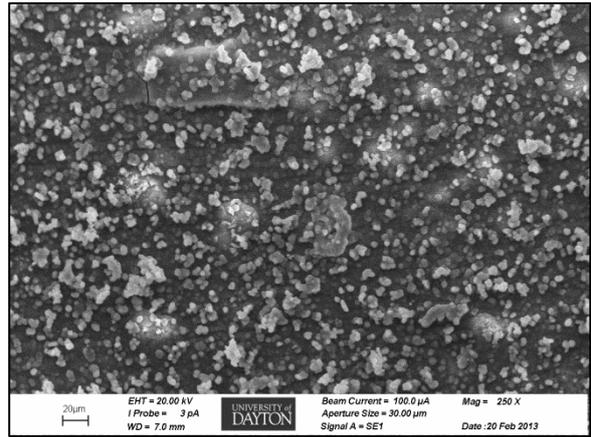


(d)

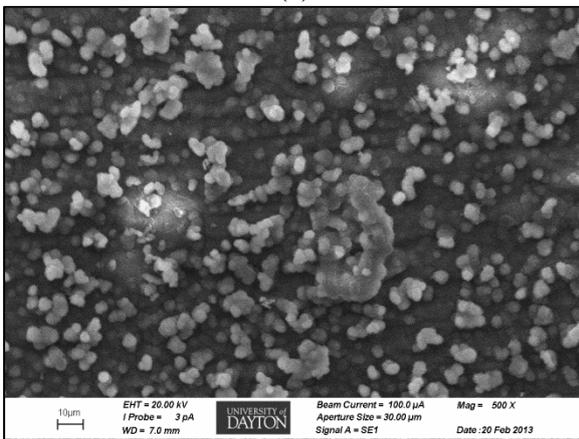
Figure N-22. SEM images of aluminum alloy 6061 sample retrieved on 900 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



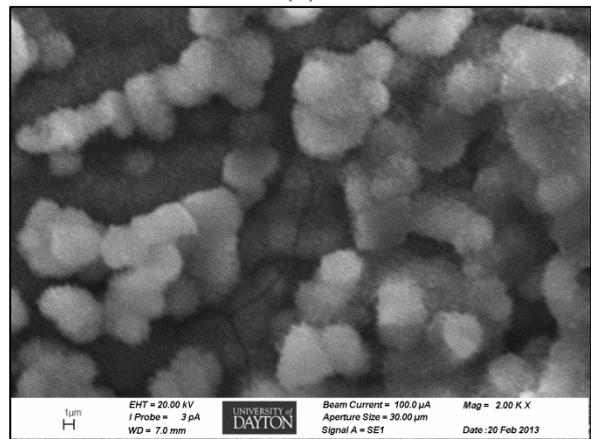
(a)



(b)

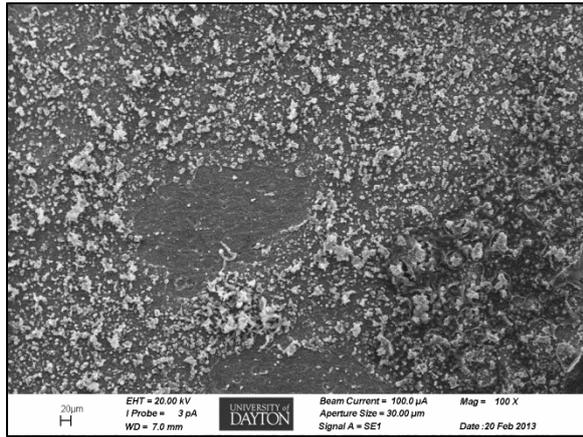


(c)

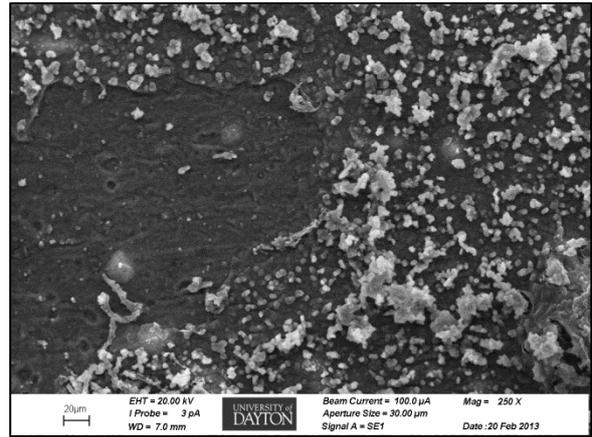


(d)

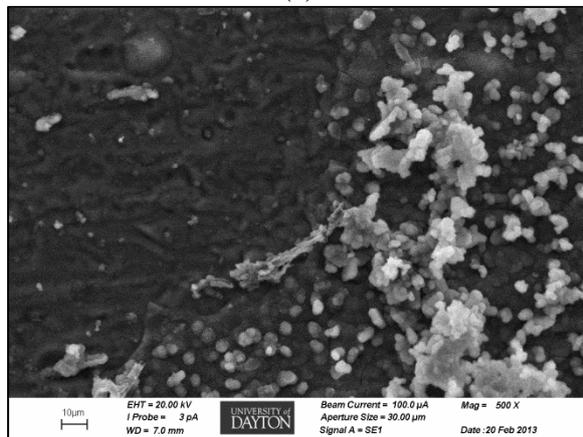
Figure N-23. SEM images of aluminum alloy 6061 sample retrieved on 800 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



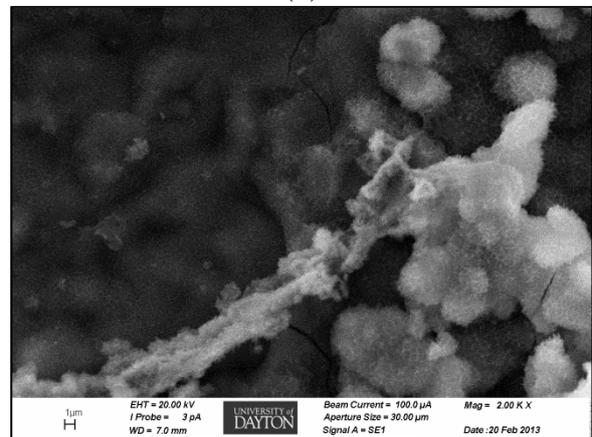
(a)



(b)

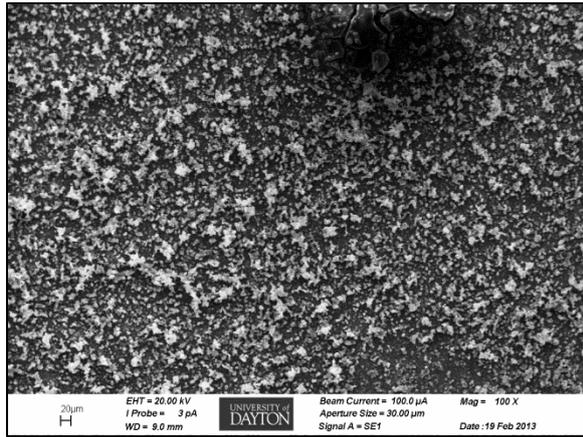


(c)

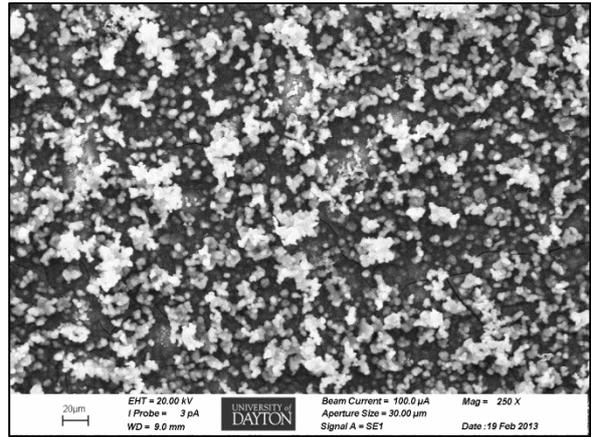


(d)

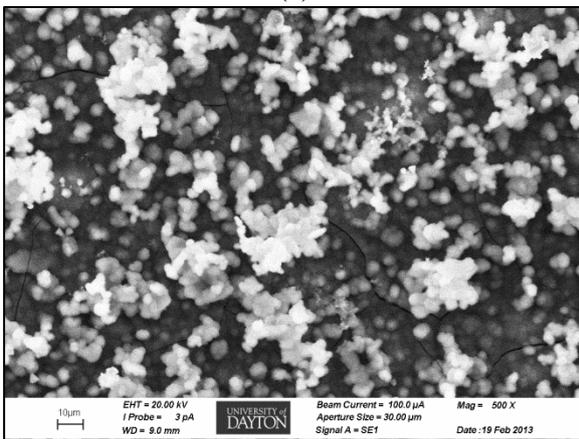
Figure N-24. SEM images of aluminum alloy 6061 sample retrieved on 700 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



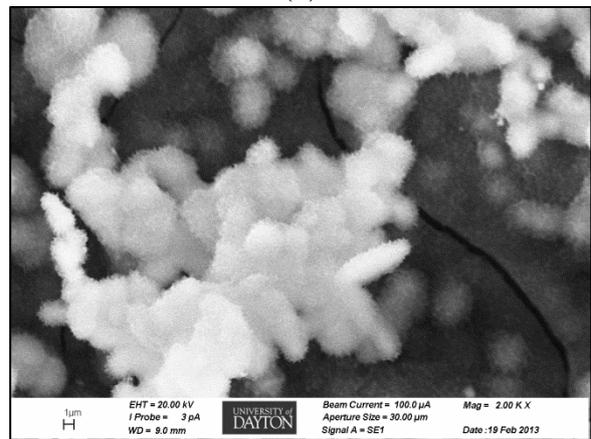
(a)



(b)

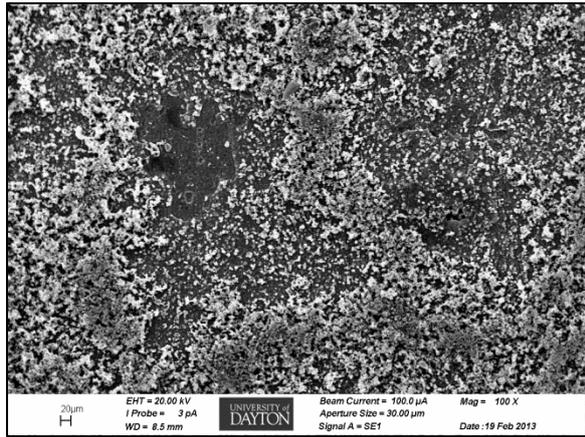


(c)

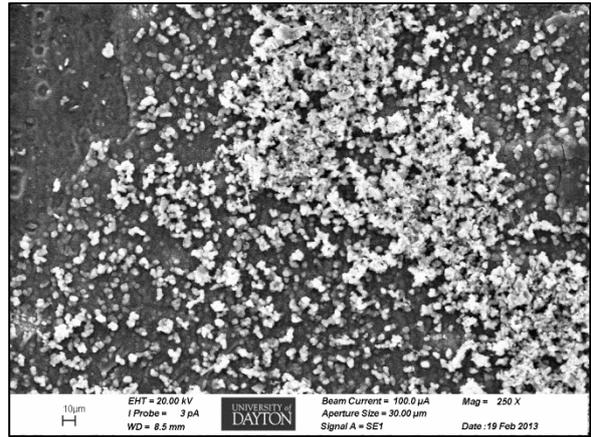


(d)

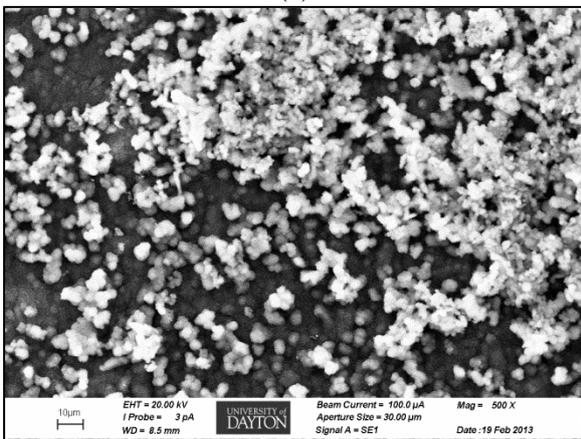
Figure N-25. SEM images of aluminum alloy 6061 sample retrieved on 600 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



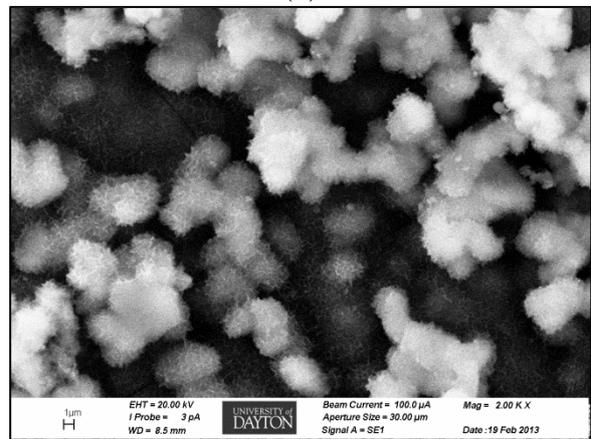
(a)



(b)

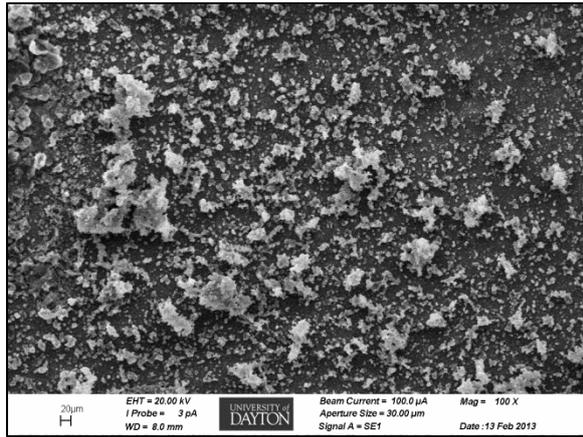


(c)

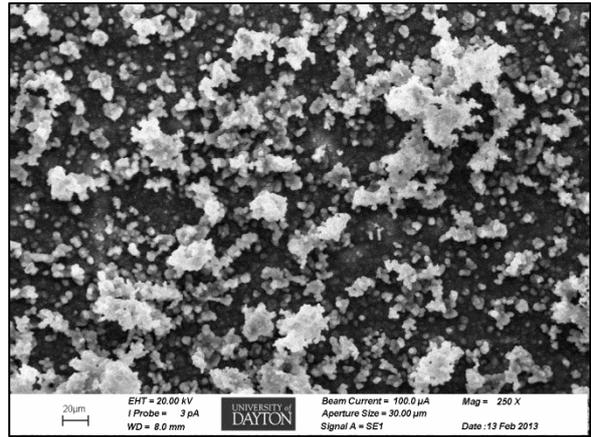


(d)

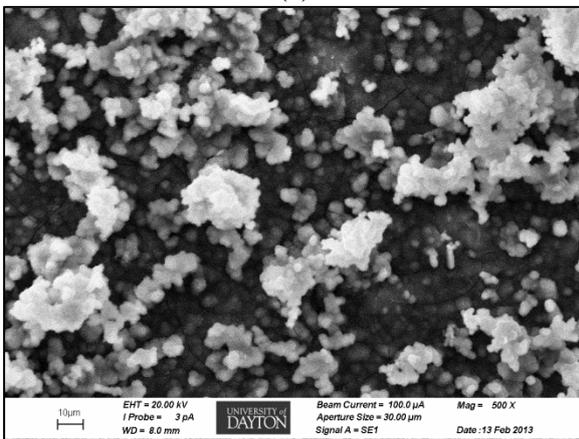
Figure N-26. SEM images of aluminum alloy 6061 sample retrieved on 500 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



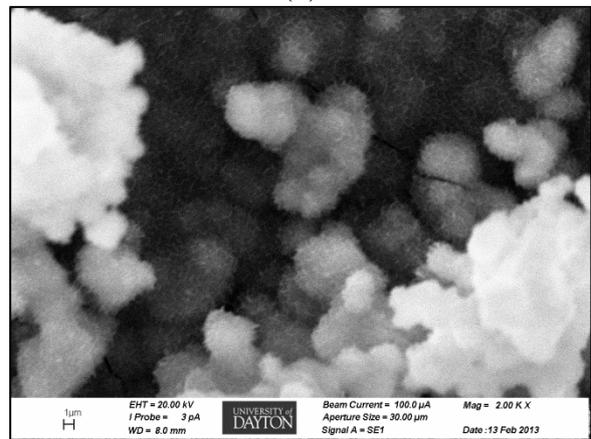
(a)



(b)

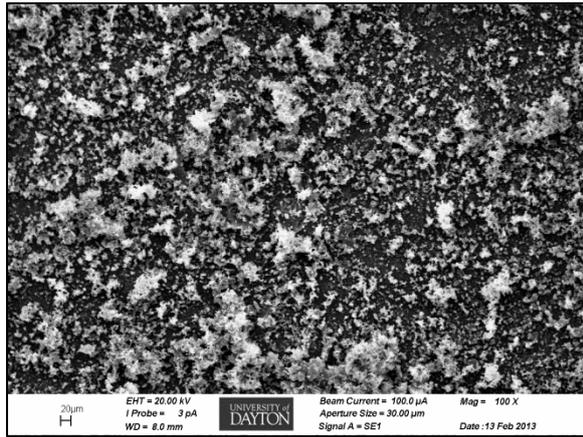


(c)

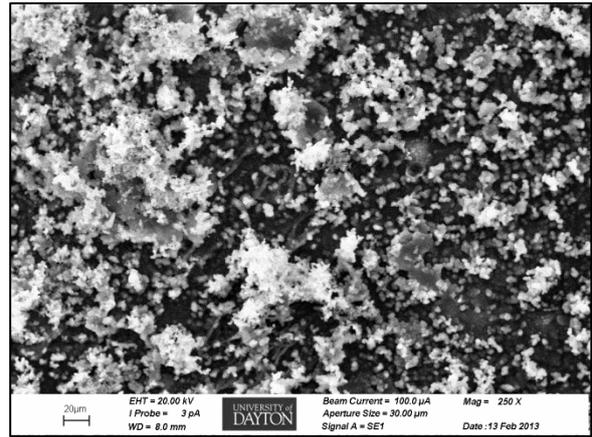


(d)

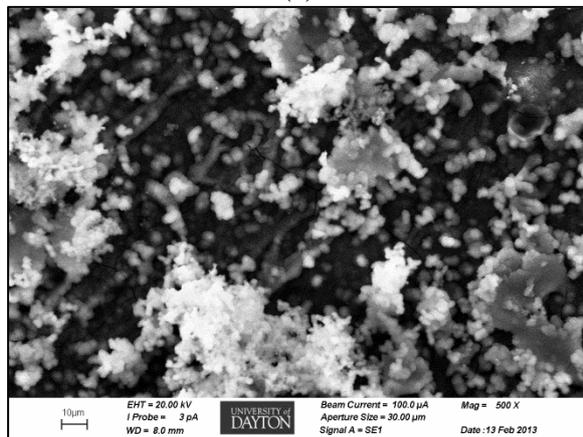
Figure N-27. SEM images of aluminum alloy 6061 sample retrieved on 400 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



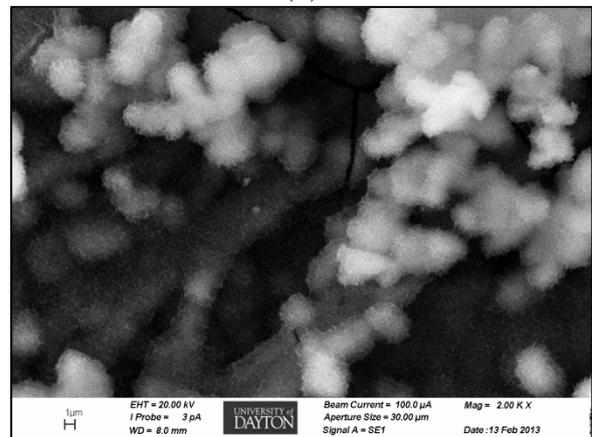
(a)



(b)

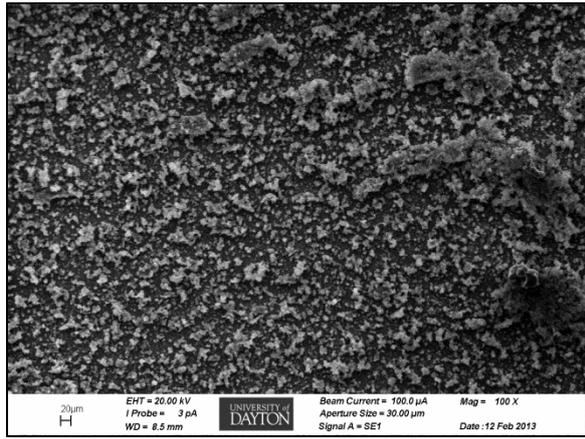


(c)

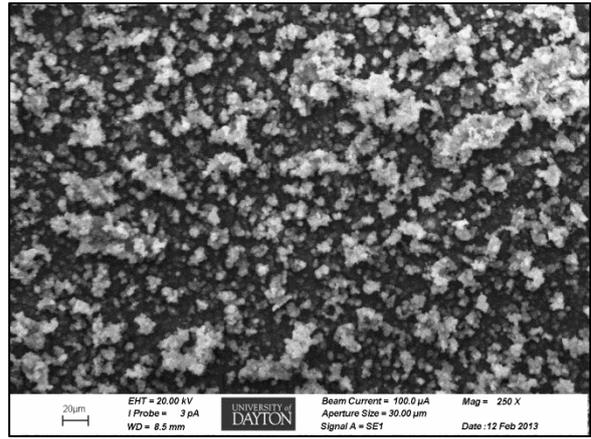


(d)

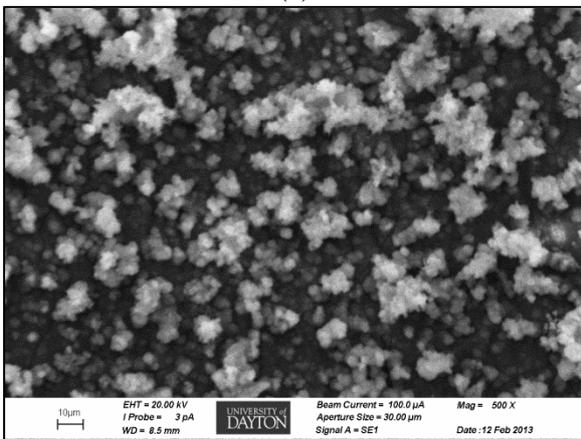
Figure N-28. SEM images of aluminum alloy 6061 sample retrieved on 300 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



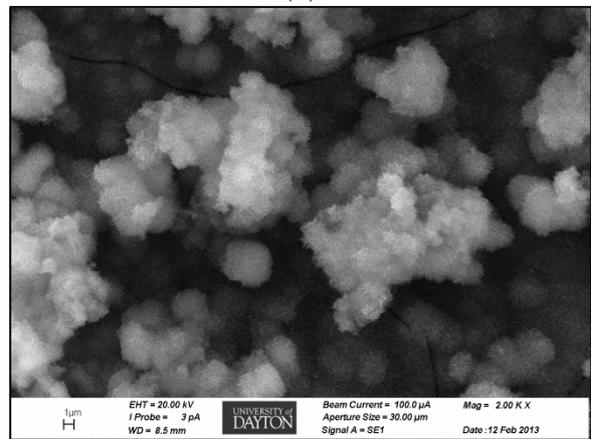
(a)



(b)

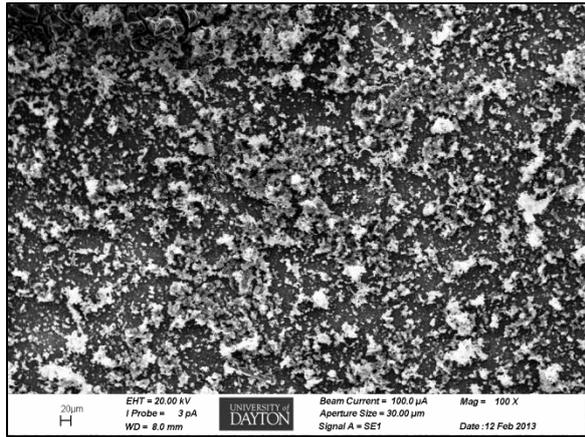


(c)

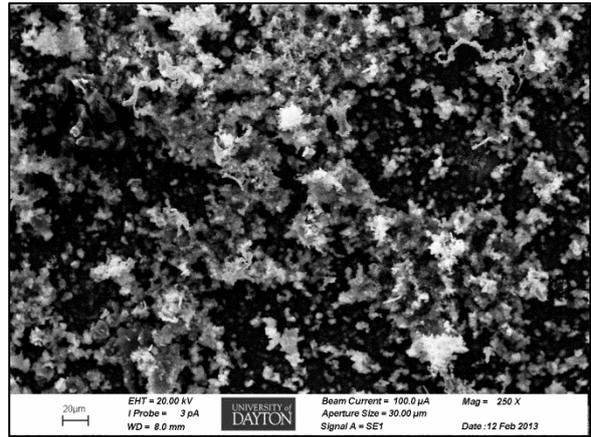


(d)

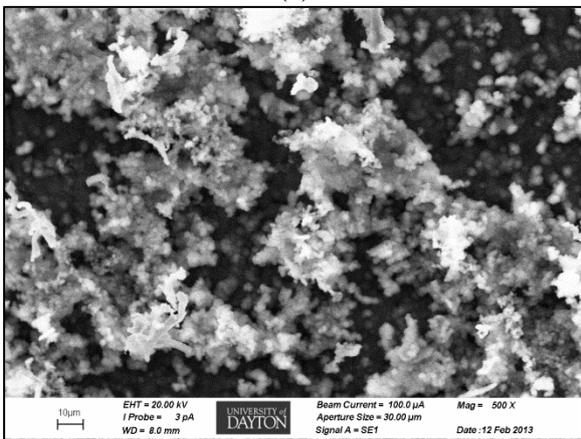
Figure N-29. SEM images of aluminum alloy 6061 sample retrieved on 200 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



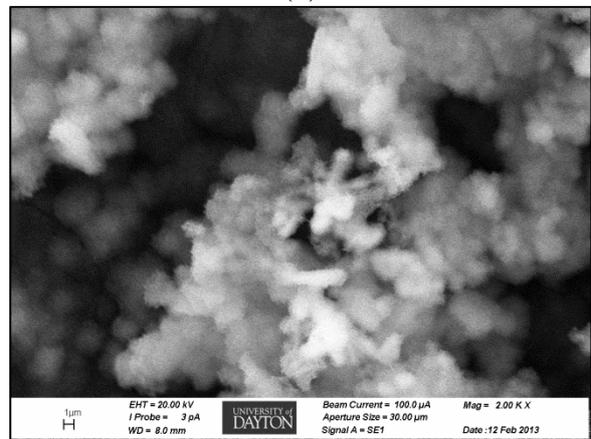
(a)



(b)

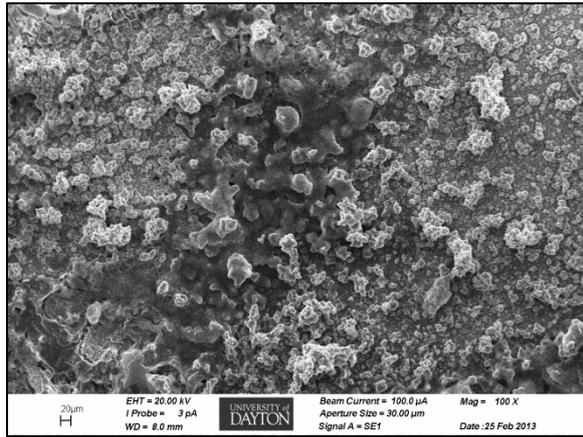


(c)

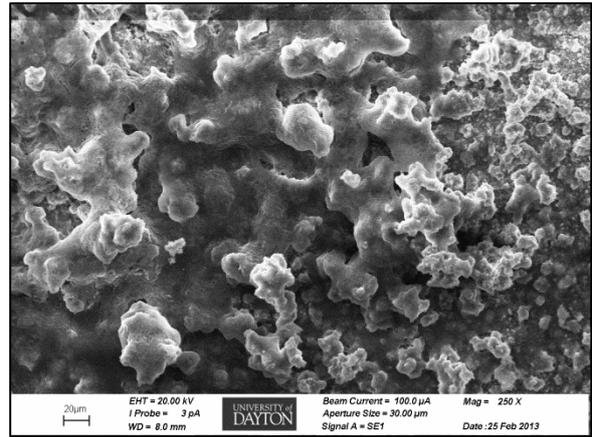


(d)

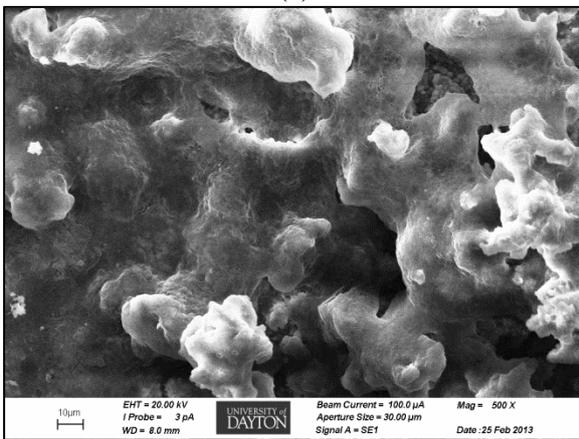
Figure N-30. SEM images of aluminum alloy 6061 sample retrieved on 100 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



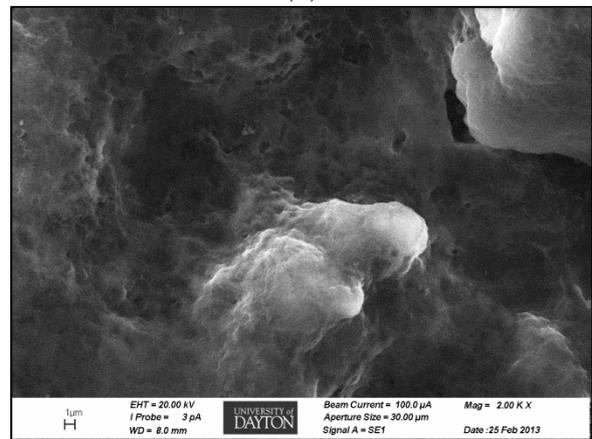
(a)



(b)

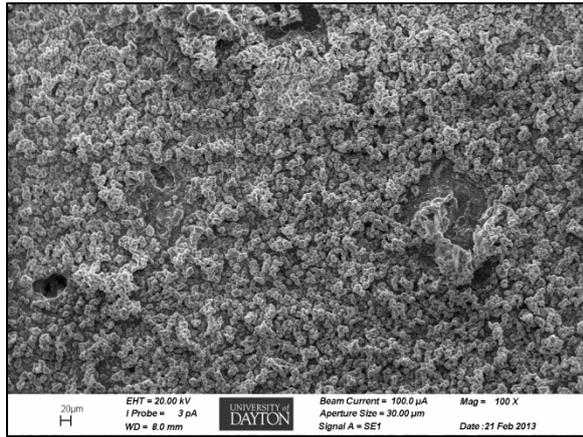


(c)

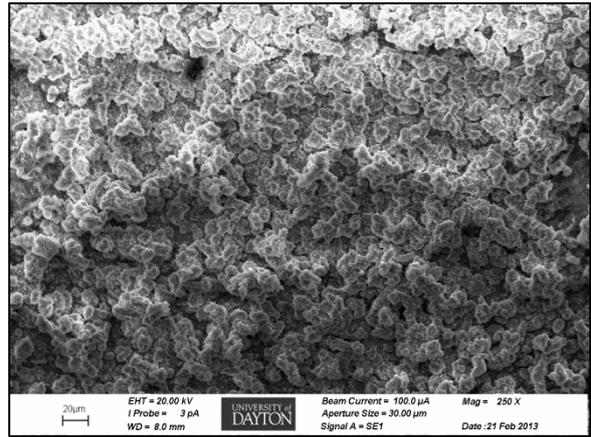


(d)

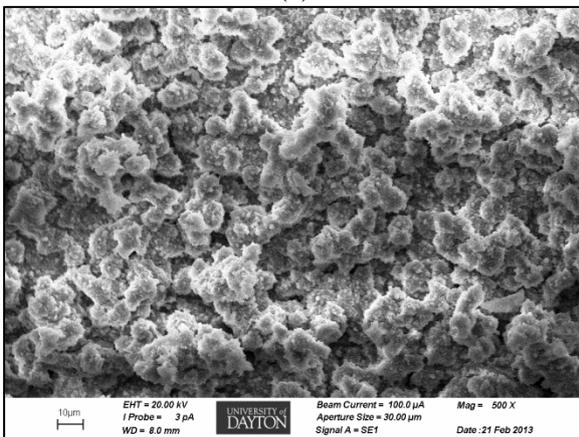
Figure N-31. SEM images of aluminum alloy 2024 sample retrieved on 1000 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



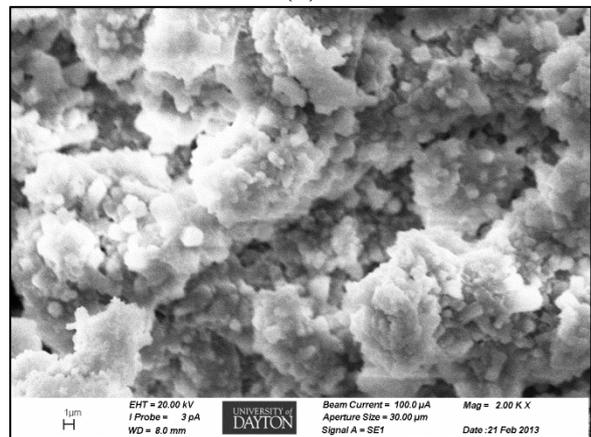
(a)



(b)

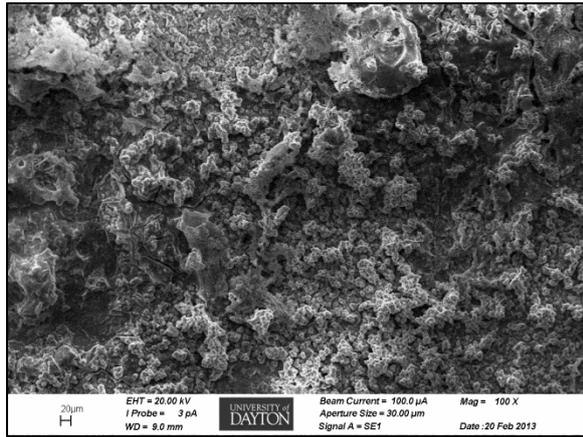


(c)

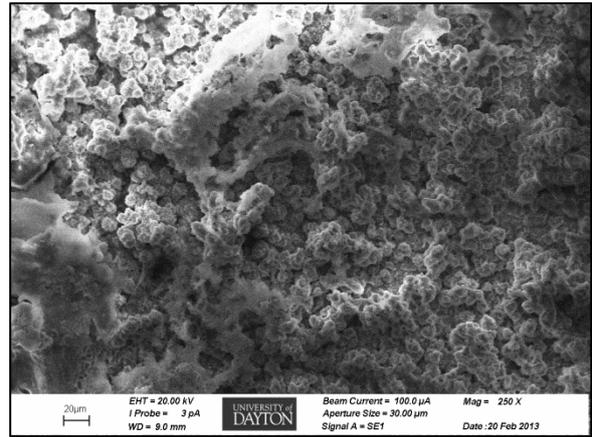


(d)

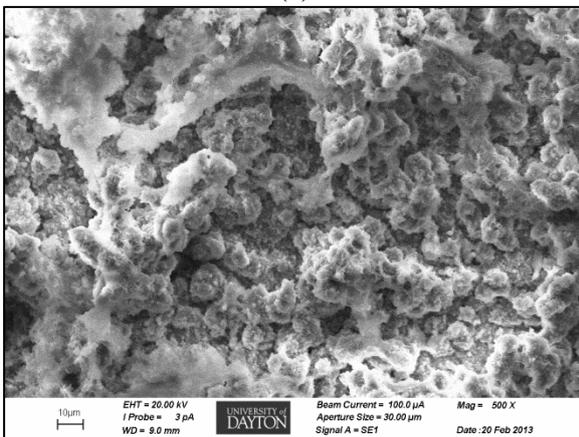
Figure N-32. SEM images of aluminum alloy 2024 sample retrieved on 900 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



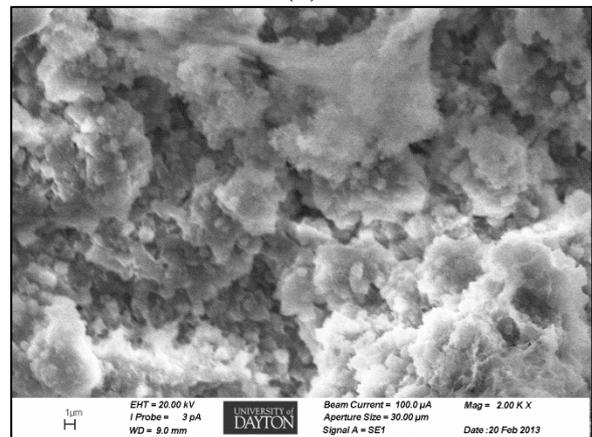
(a)



(b)

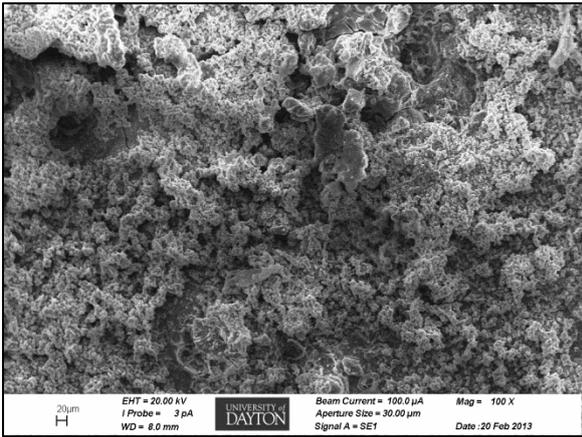


(c)

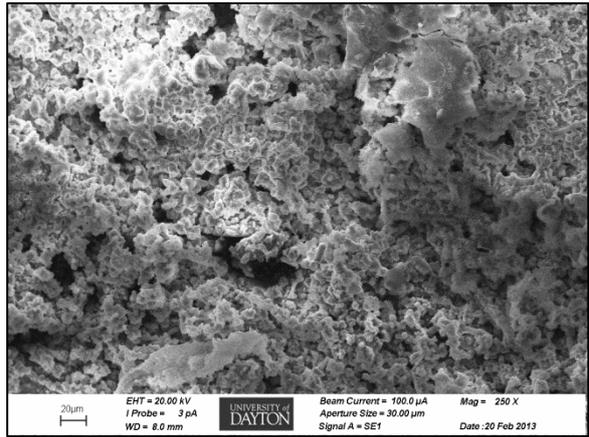


(d)

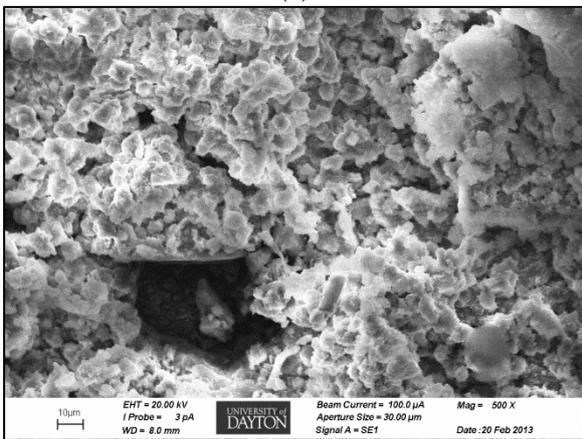
Figure N-33. SEM images of aluminum alloy 2024 sample retrieved on 800 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



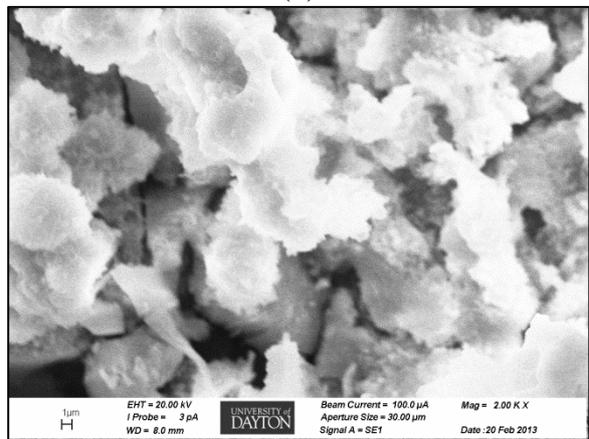
(a)



(b)

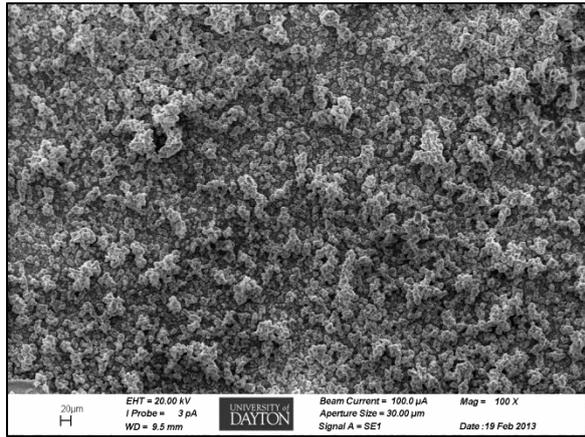


(c)

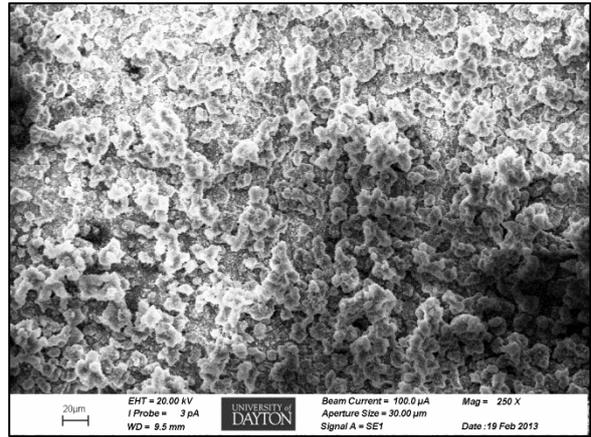


(d)

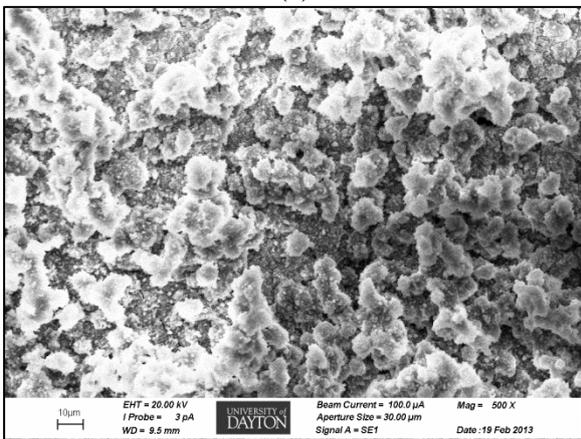
Figure N-34. SEM images of aluminum alloy 2024 sample retrieved on 700 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



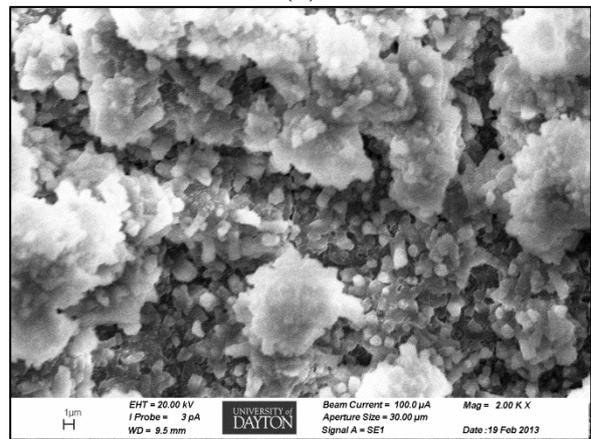
(a)



(b)

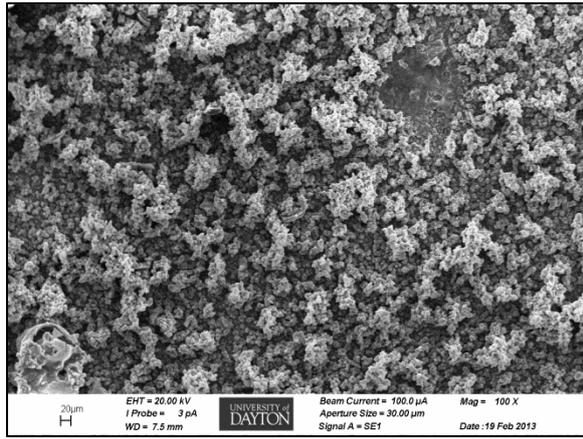


(c)

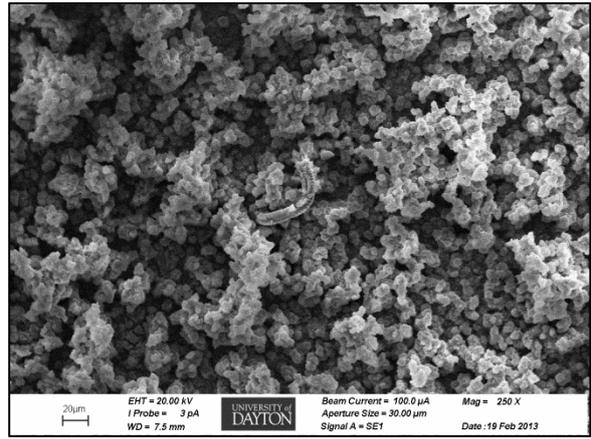


(d)

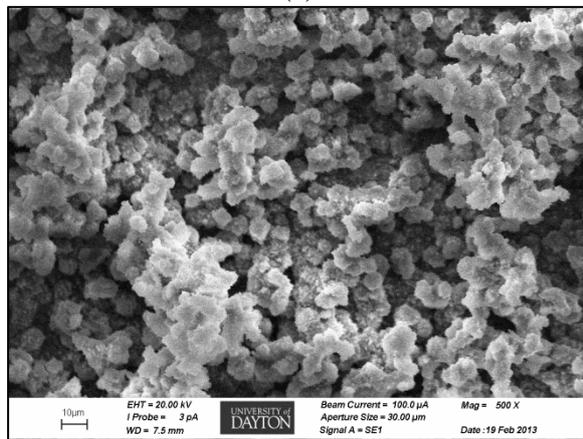
Figure N-35. SEM images of aluminum alloy 2024 sample retrieved on 600 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



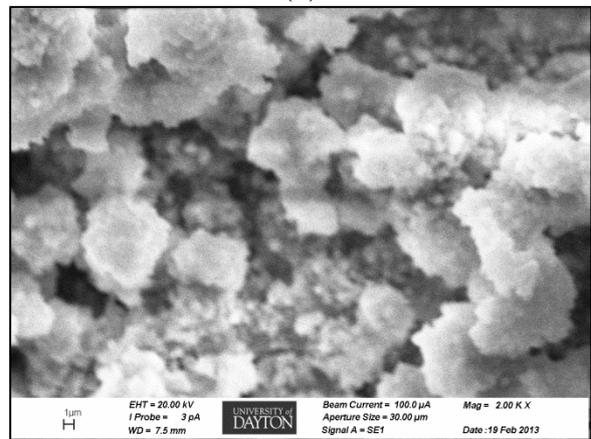
(a)



(b)

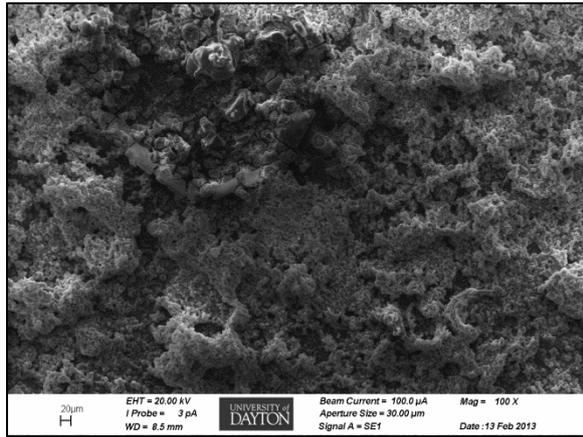


(c)

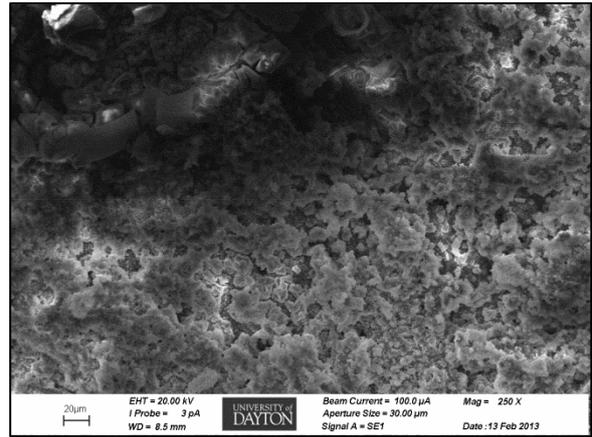


(d)

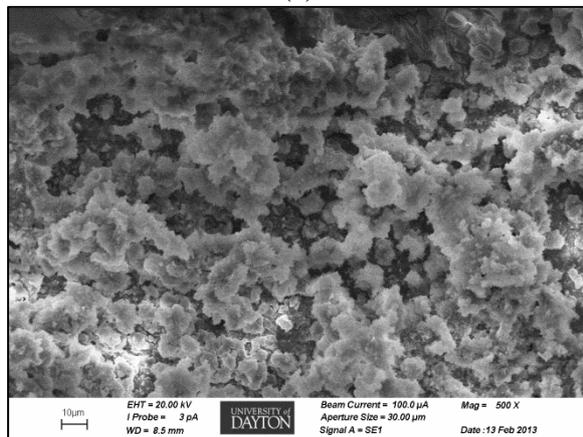
Figure N-36. SEM images of aluminum alloy 2024 sample retrieved on 500 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



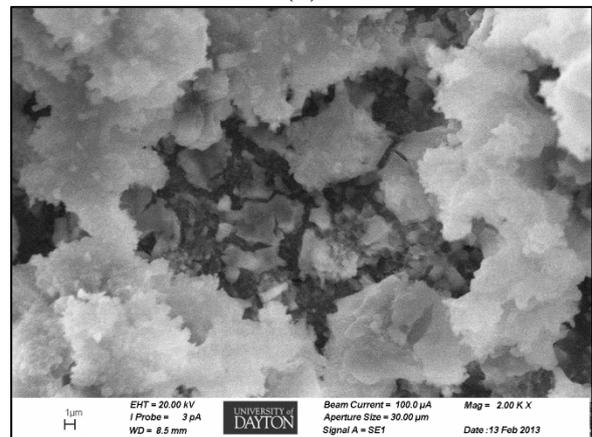
(a)



(b)

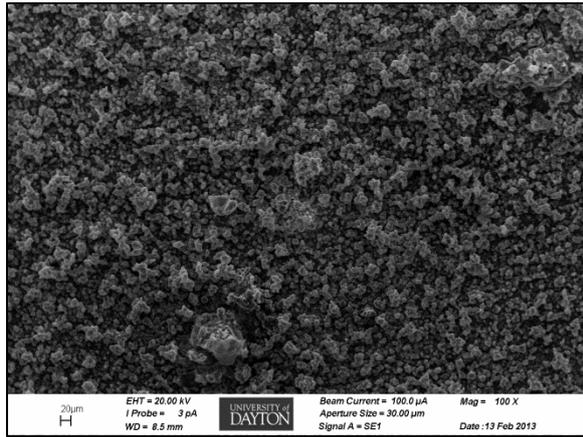


(c)

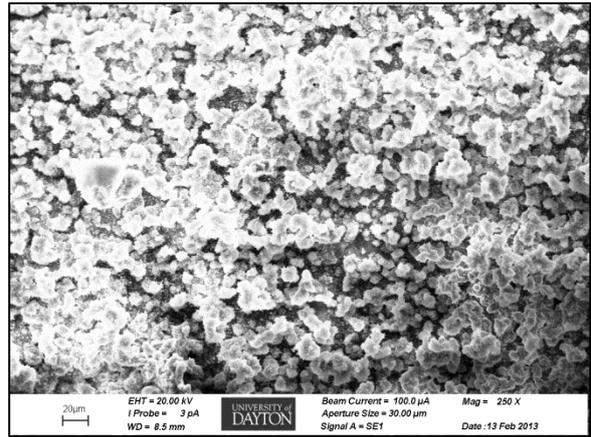


(d)

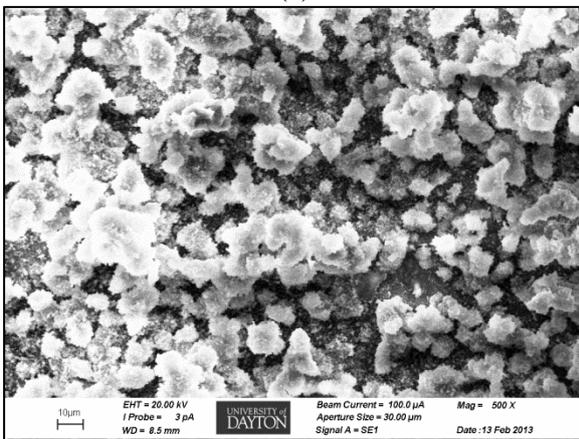
Figure N-37. SEM images of aluminum alloy 2024 sample retrieved on 400 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification., and (d) 2000X magnification.



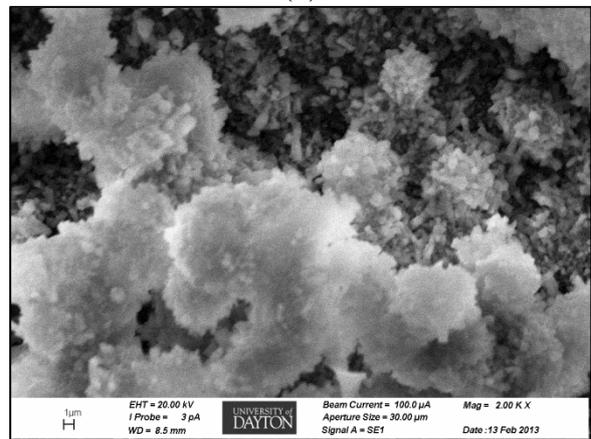
(a)



(b)

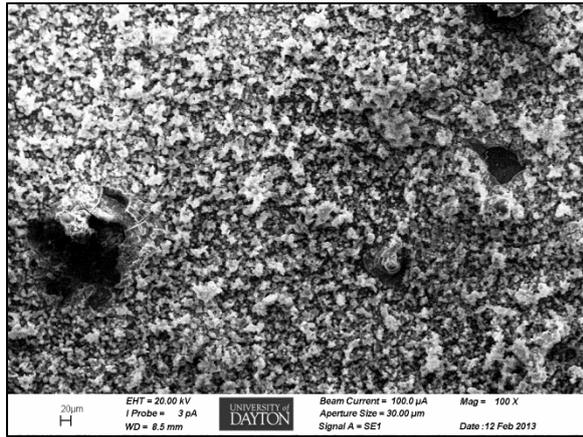


(c)

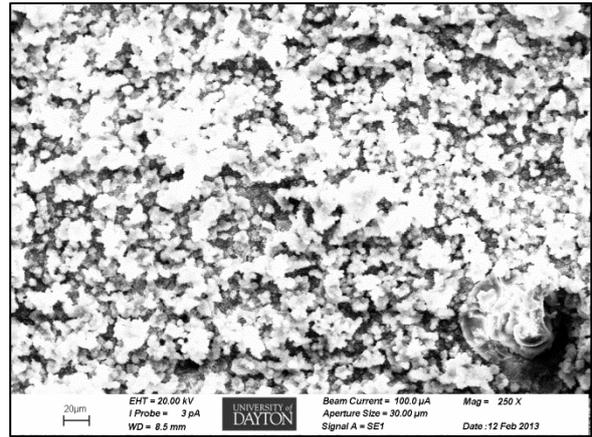


(d)

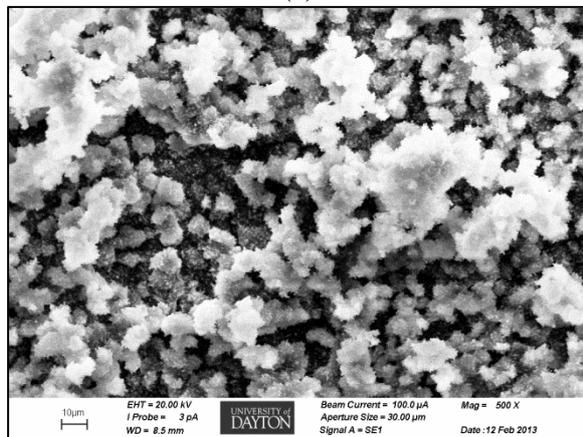
Figure N-38. SEM images of aluminum alloy 2024 sample retrieved on 300 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



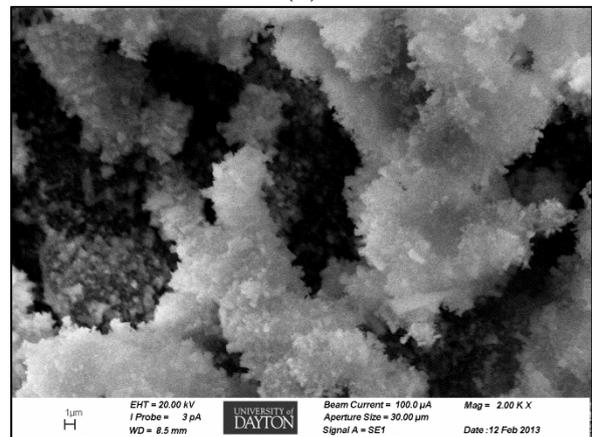
(a)



(b)

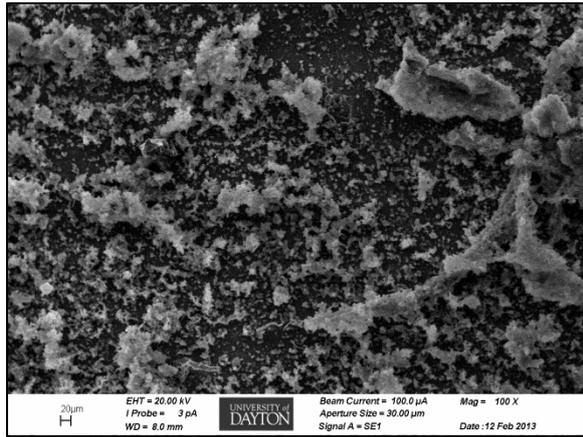


(c)

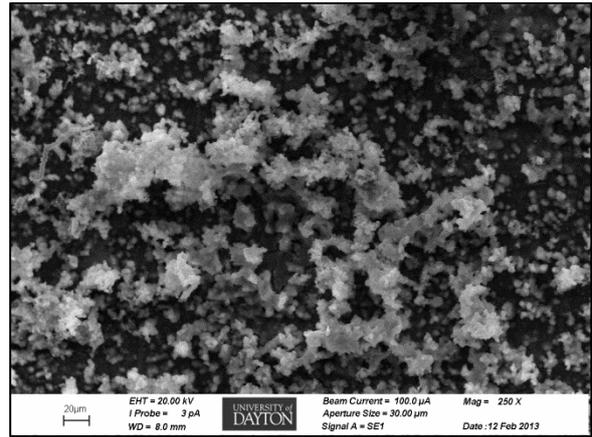


(d)

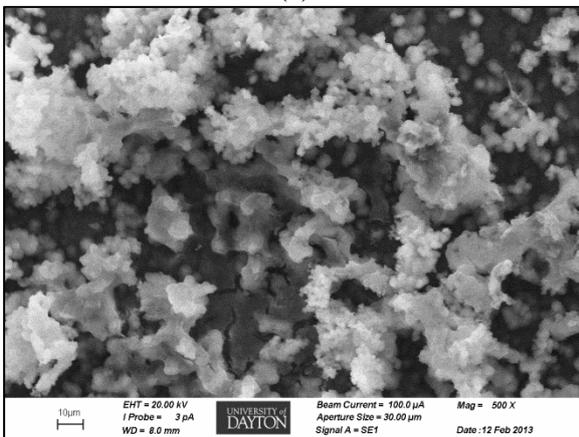
Figure N-39. SEM images of aluminum alloy 2024 sample retrieved on 200 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification., and (d) 2000X magnification.



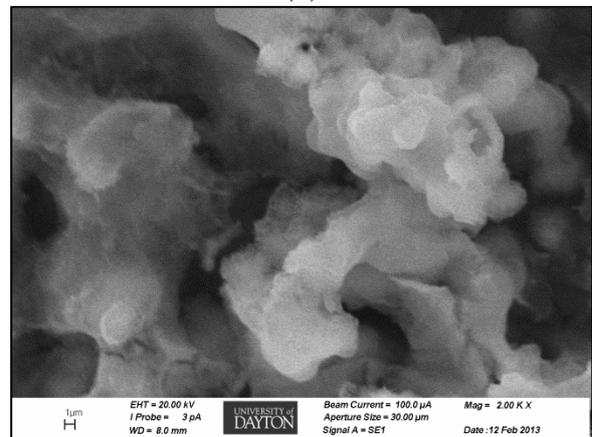
(a)



(b)

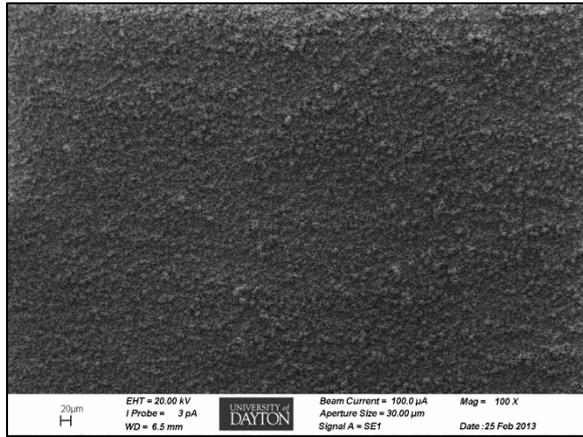


(c)

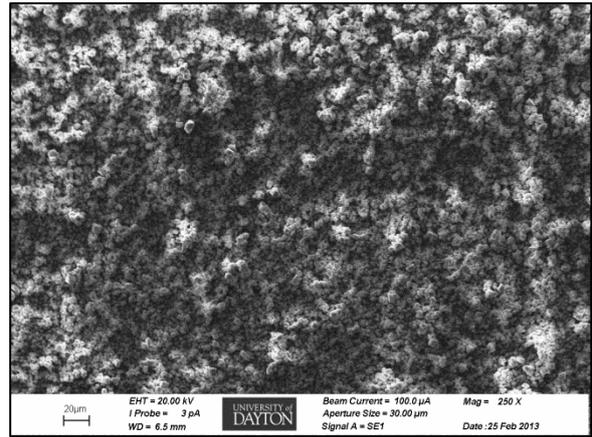


(d)

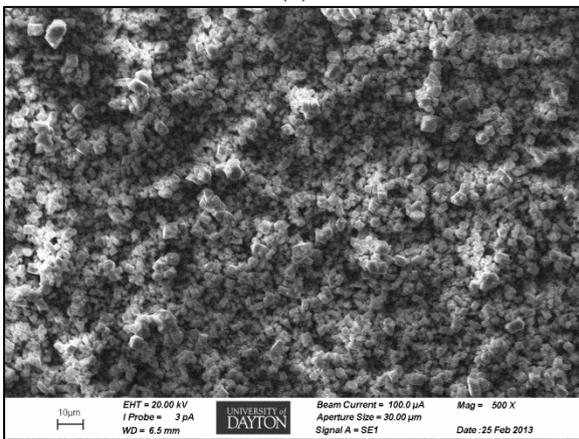
Figure N-40. SEM images of aluminum alloy 2024 sample retrieved on 100 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



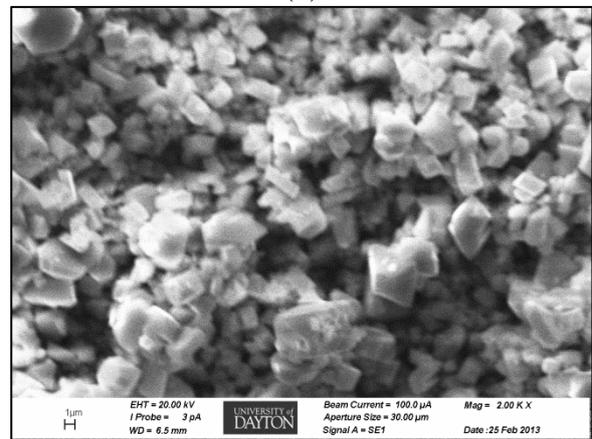
(a)



(b)

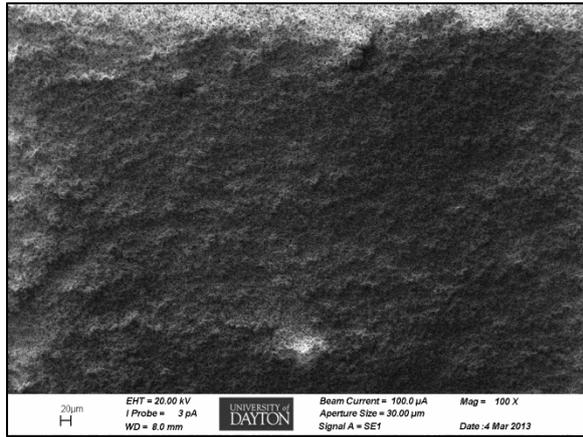


(c)

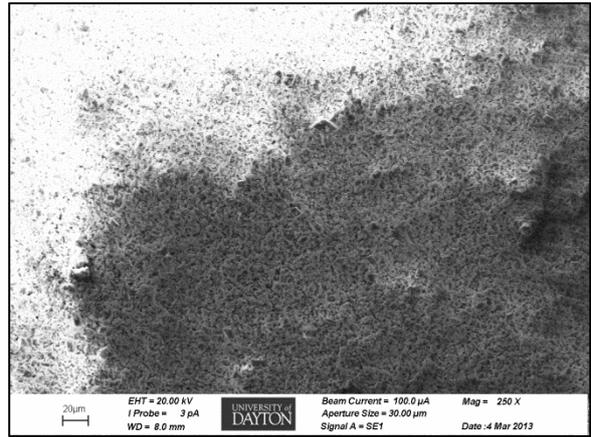


(d)

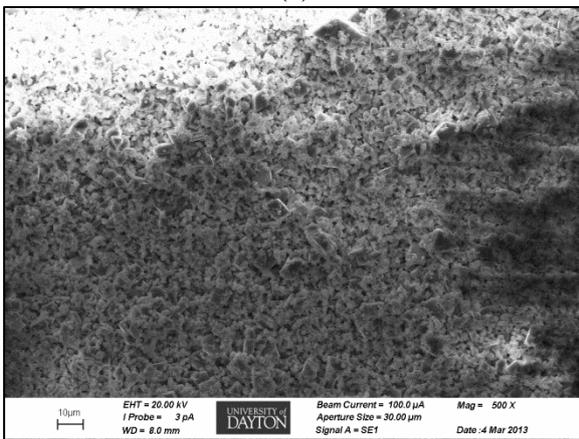
Figure N-41. SEM images of pure copper sample retrieved on 1000 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



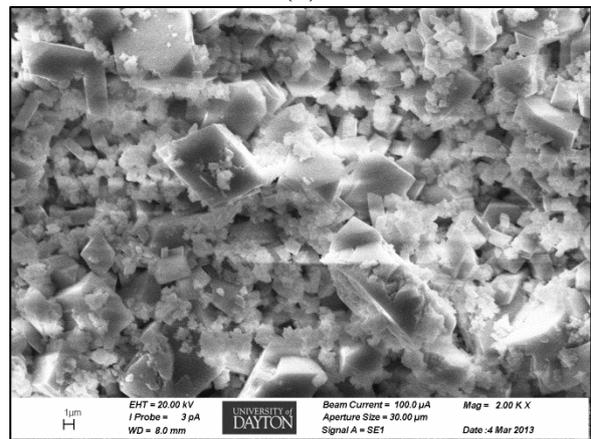
(a)



(b)

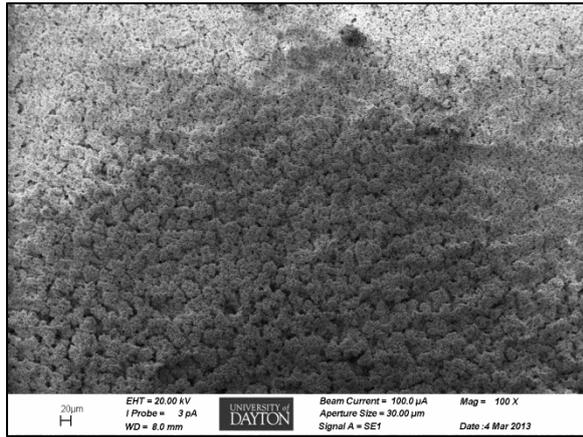


(c)

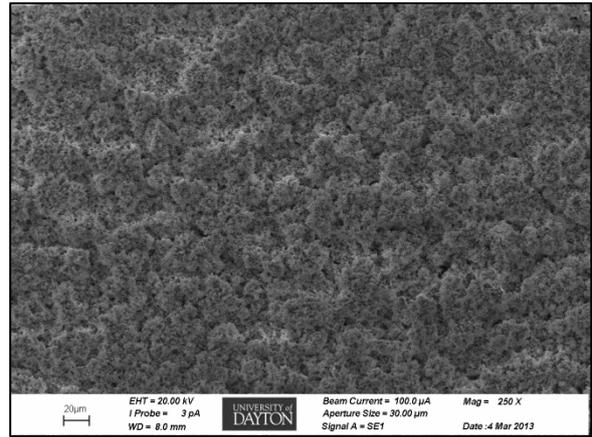


(d)

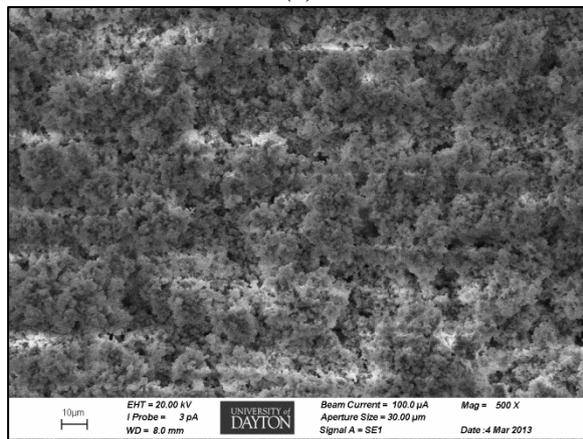
Figure N-42. SEM images of pure copper sample retrieved on 900 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



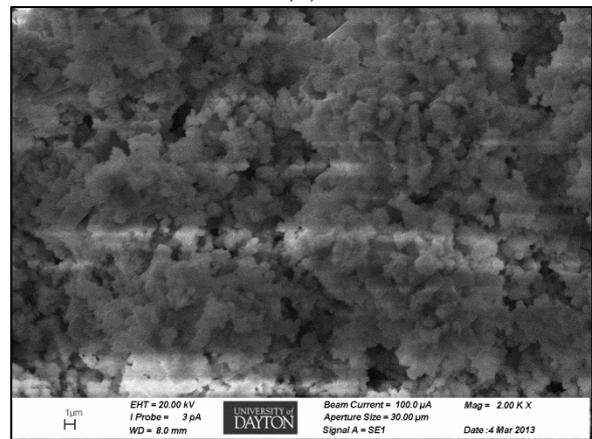
(a)



(b)

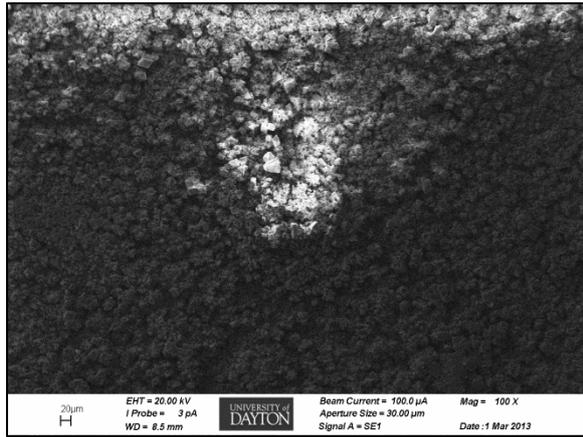


(c)

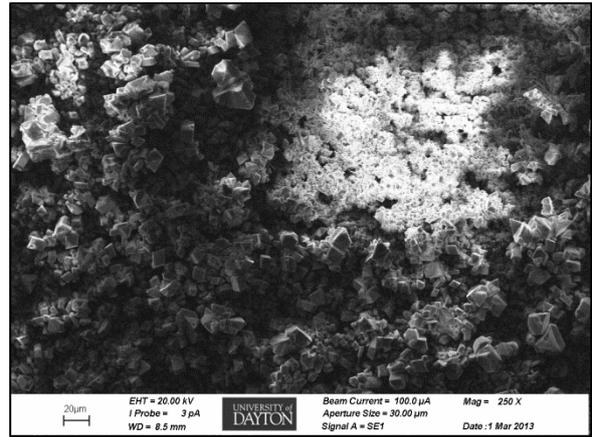


(d)

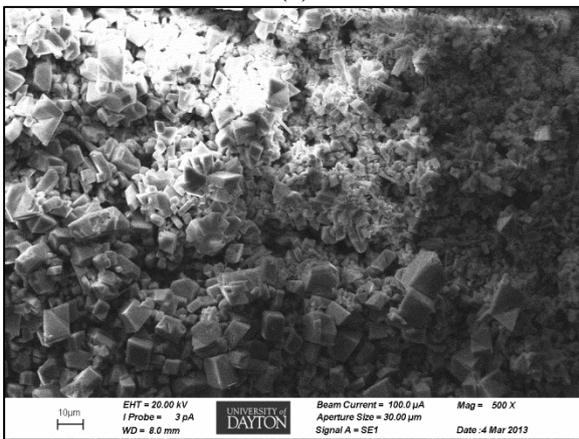
Figure N-43. SEM images of pure copper sample retrieved on 800 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



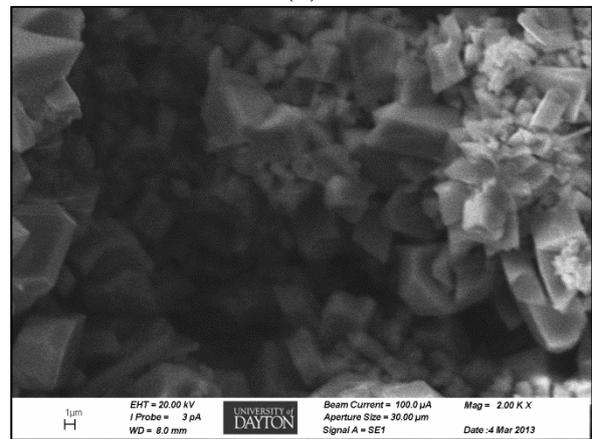
(a)



(b)

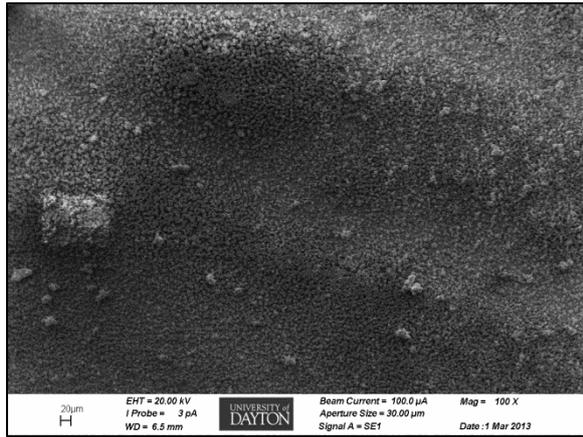


(c)

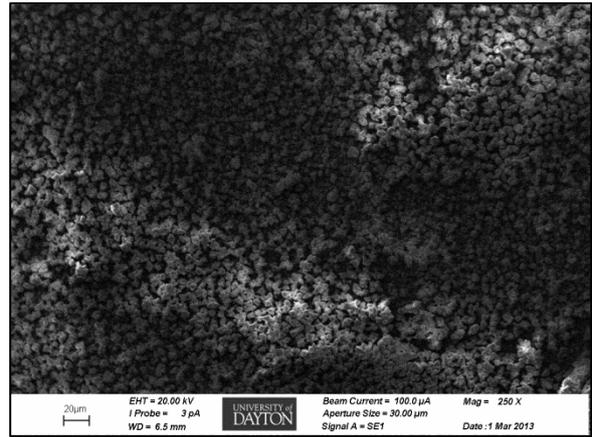


(d)

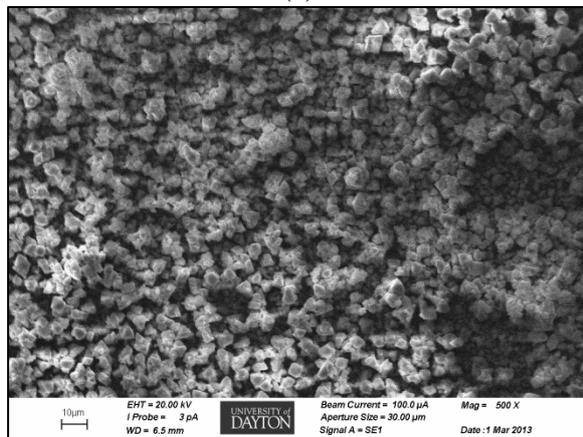
Figure N-44. SEM images of pure copper sample retrieved on 600 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



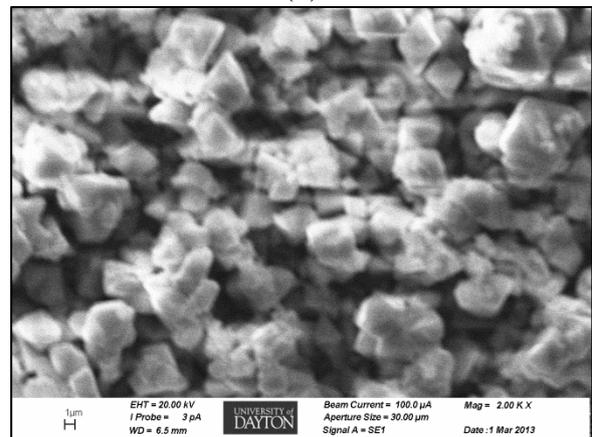
(a)



(b)

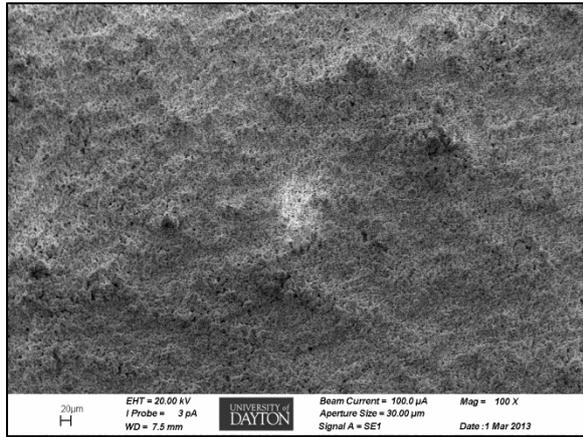


(c)

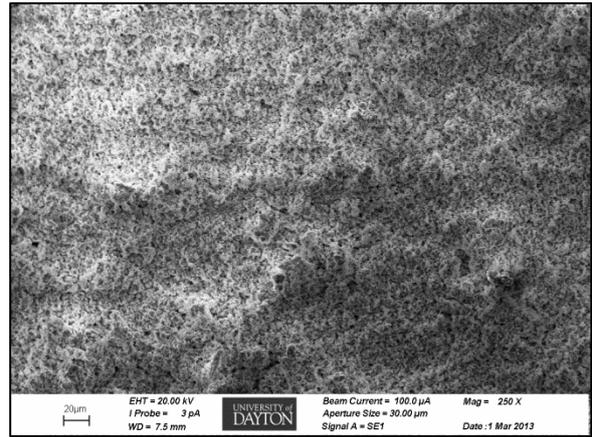


(d)

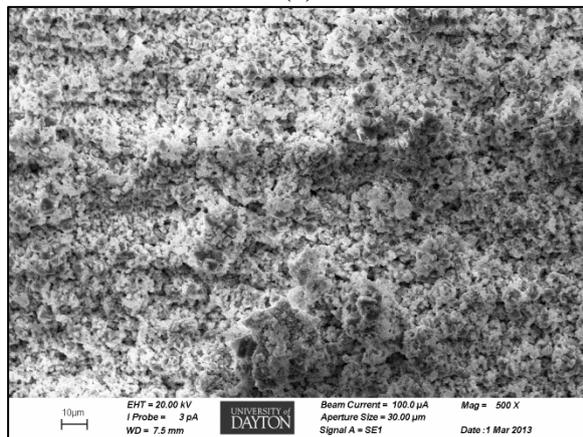
Figure N-45. SEM images of pure copper sample retrieved on 500 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



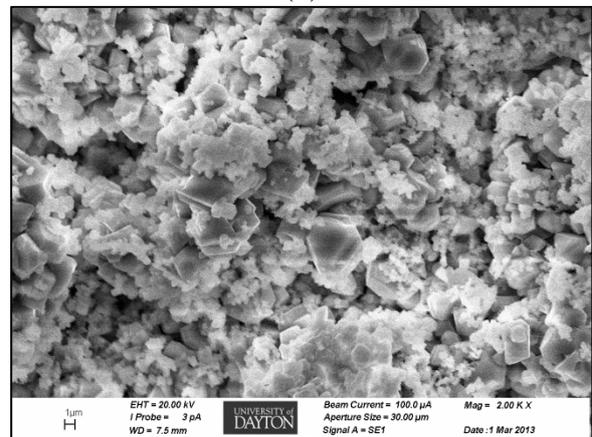
(a)



(b)

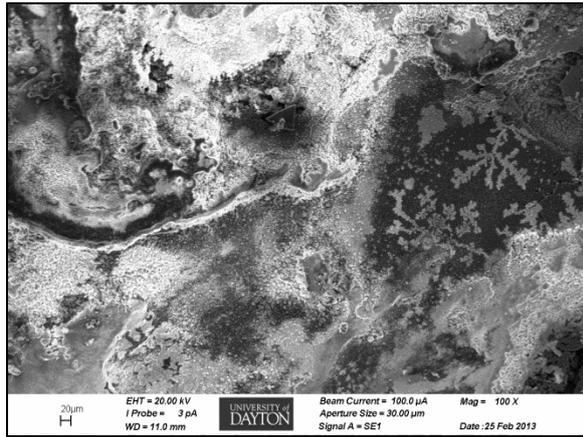


(c)

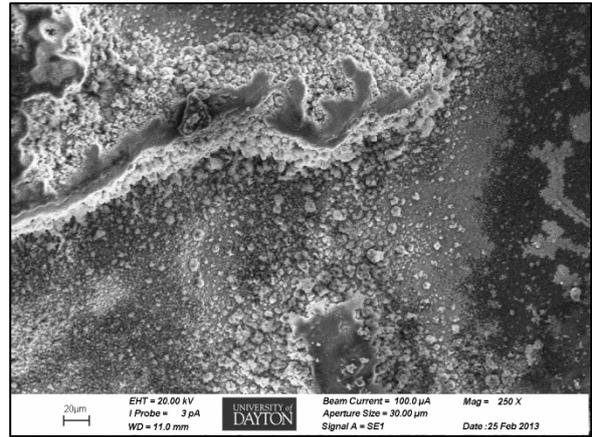


(d)

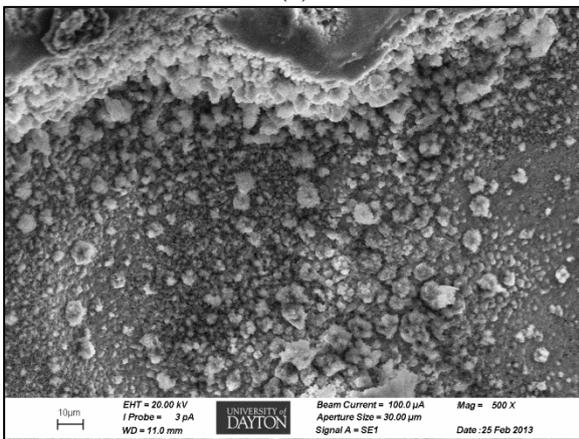
Figure N-46. SEM images of pure copper sample retrieved on 300 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification, (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



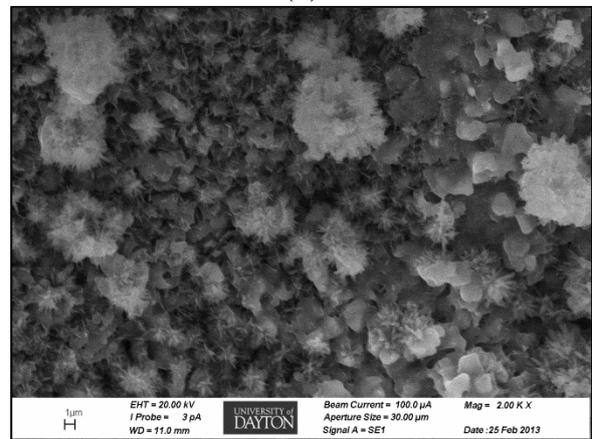
(a)



(b)

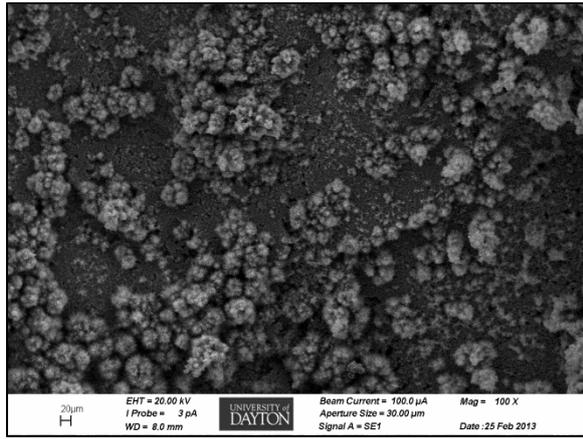


(c)

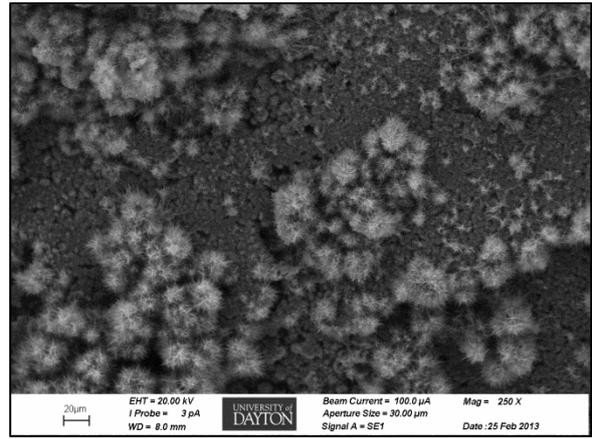


(d)

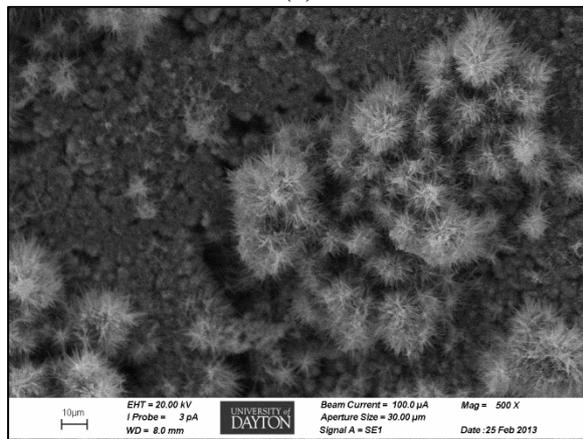
Figure N-47. SEM images of 1010 steel sample retrieved on 1000 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 500X magnification.



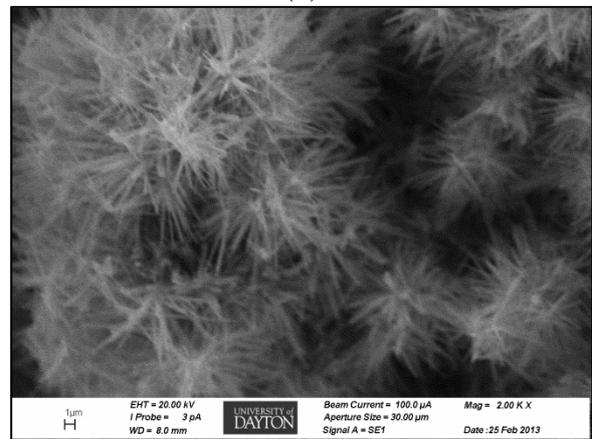
(a)



(b)

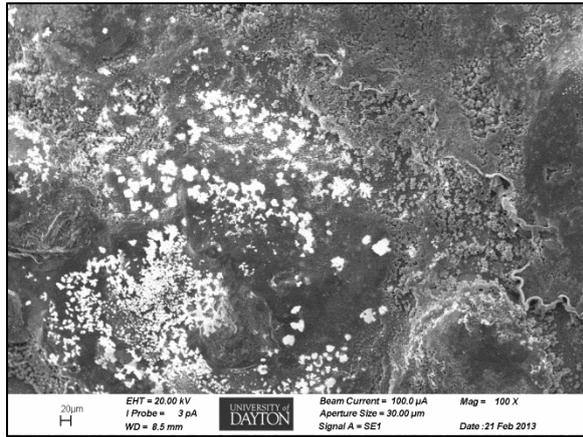


(c)

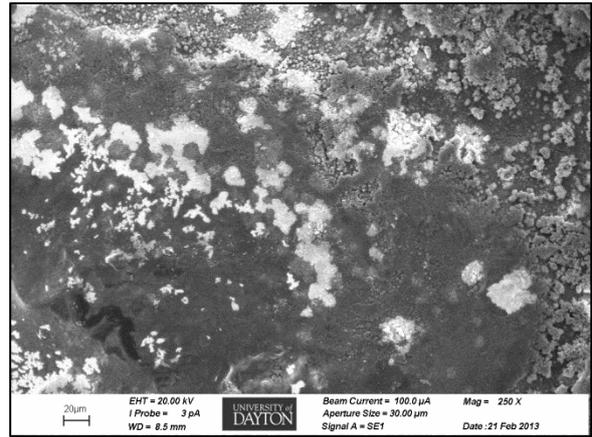


(d)

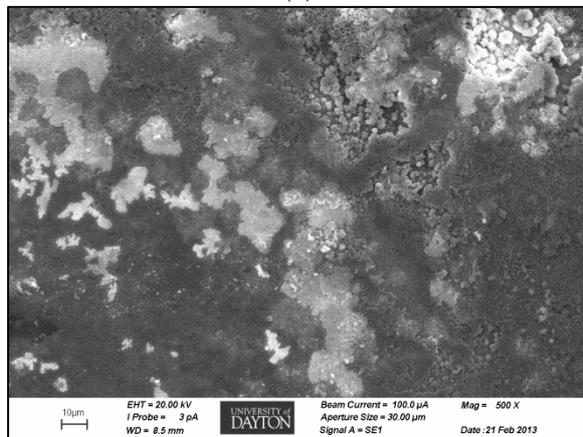
Figure N-48. SEM images of 1010 steel sample retrieved on 900 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



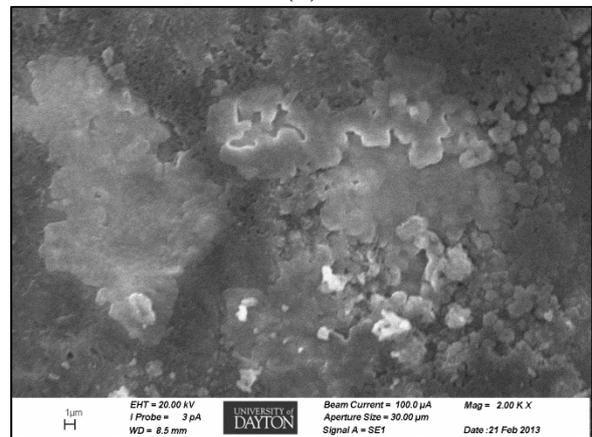
(a)



(b)

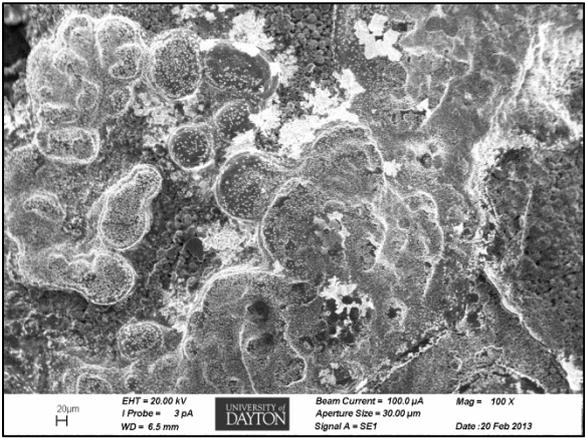


(c)

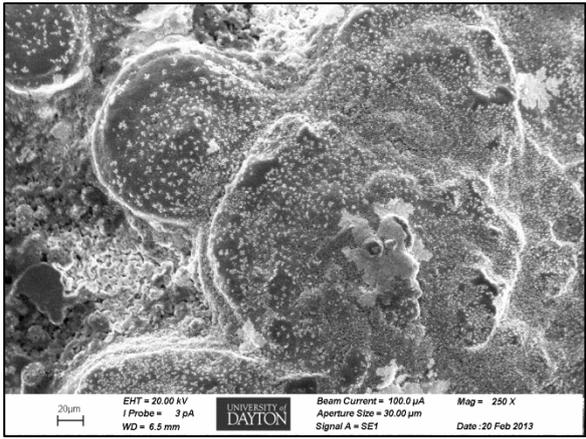


(d)

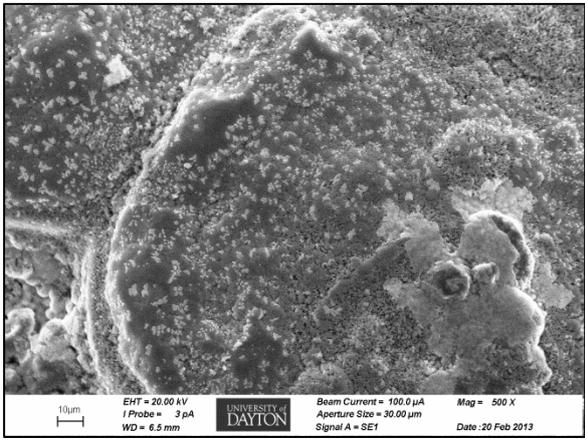
Figure N-49. SEM images of 1010 steel sample retrieved on 800 hours exposure from High UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



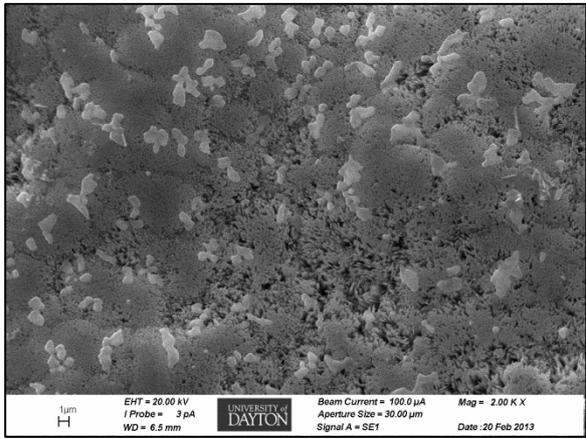
(a)



(b)

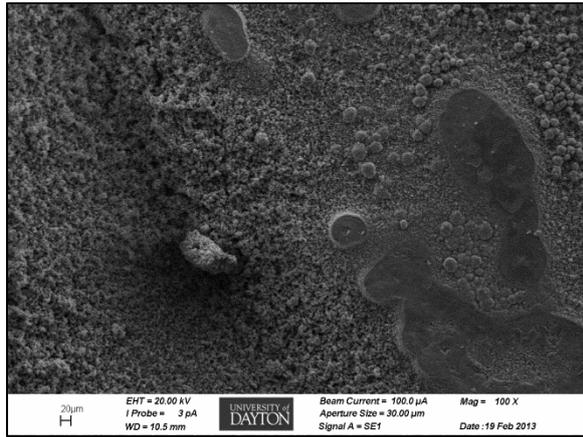


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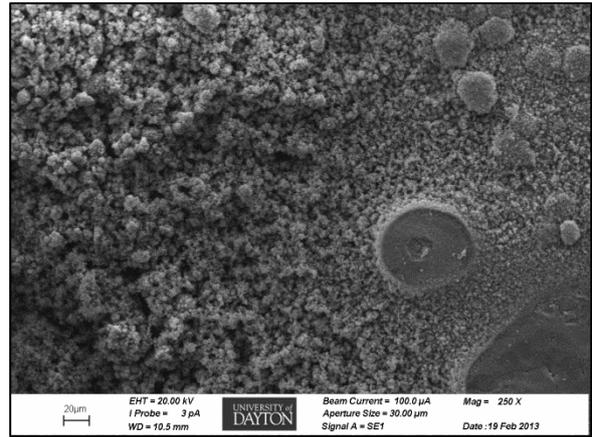


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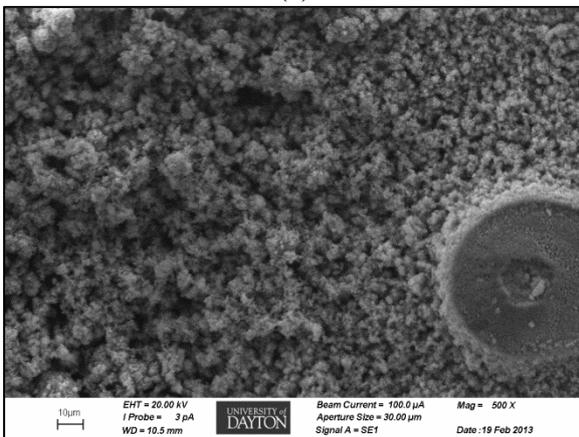
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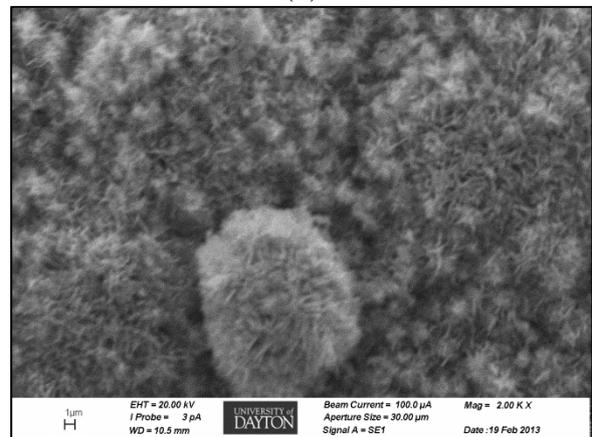
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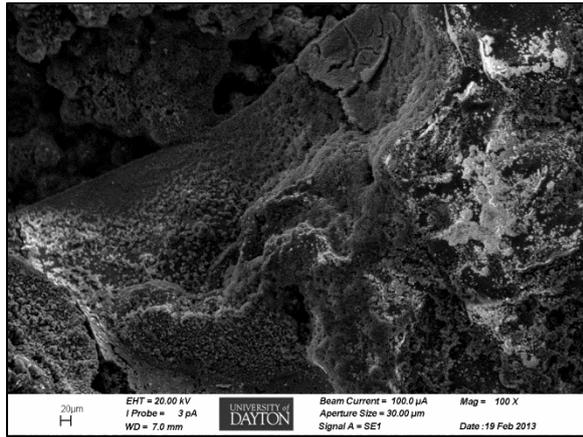


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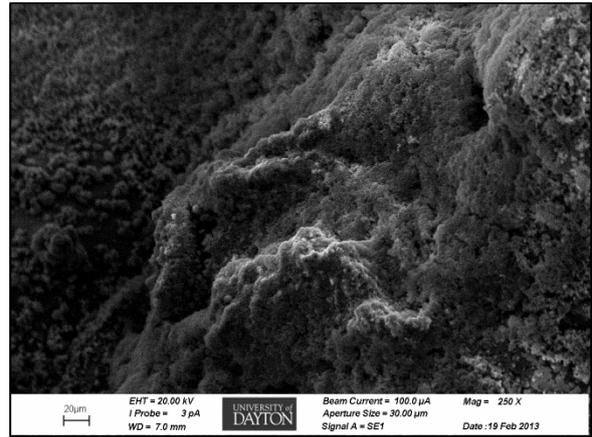


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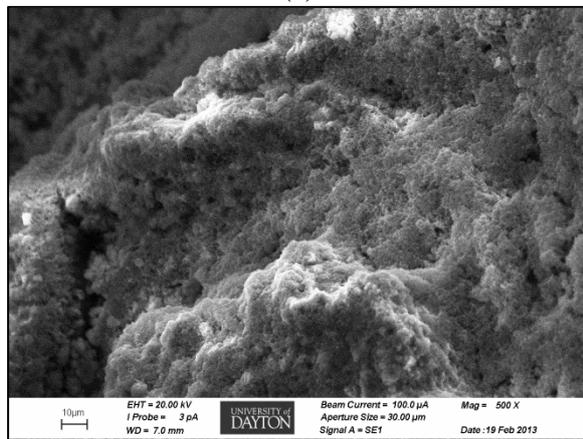
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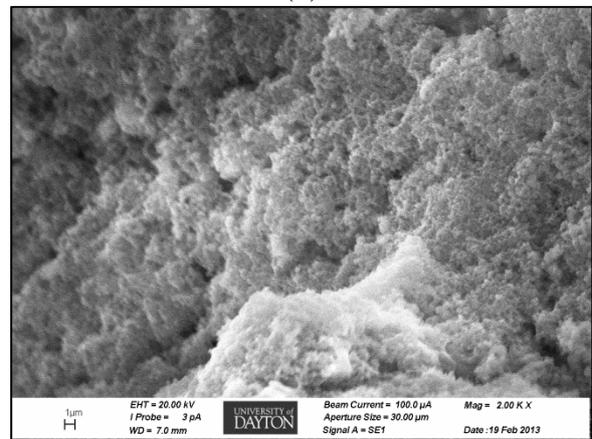
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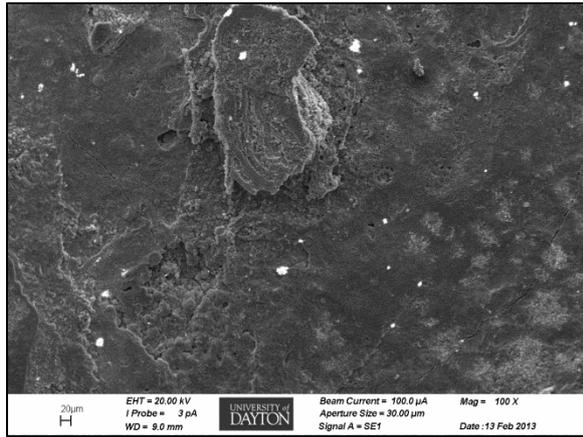


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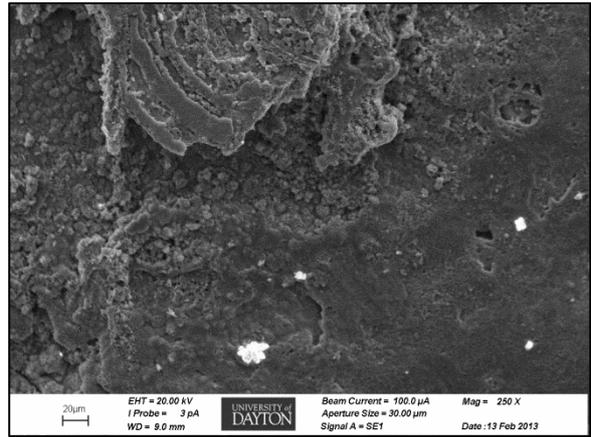


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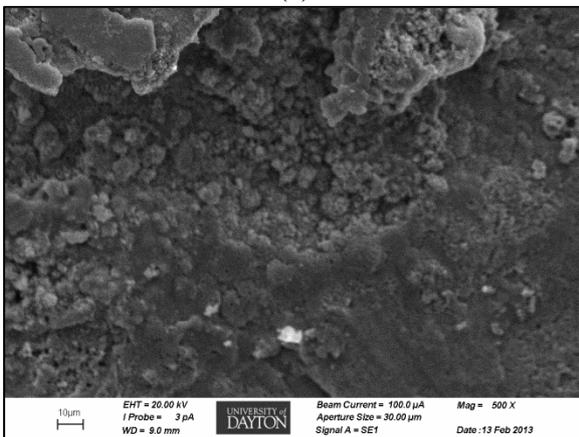
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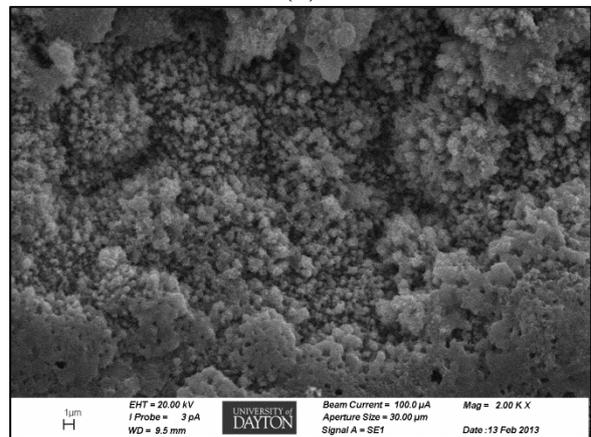
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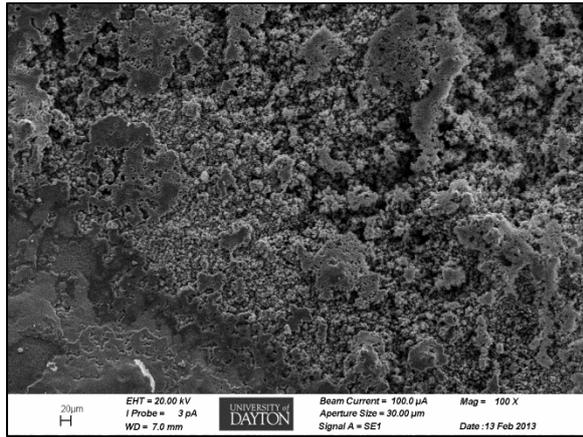


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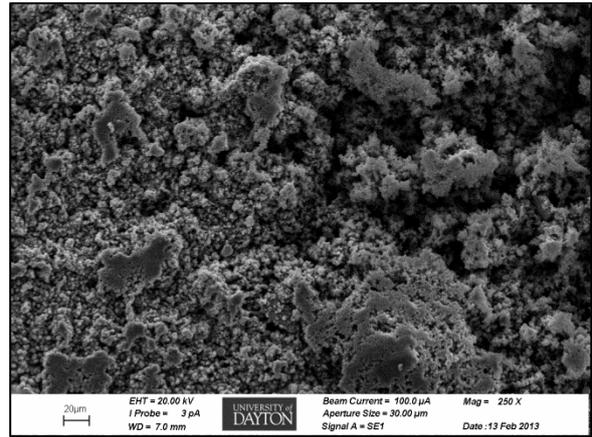


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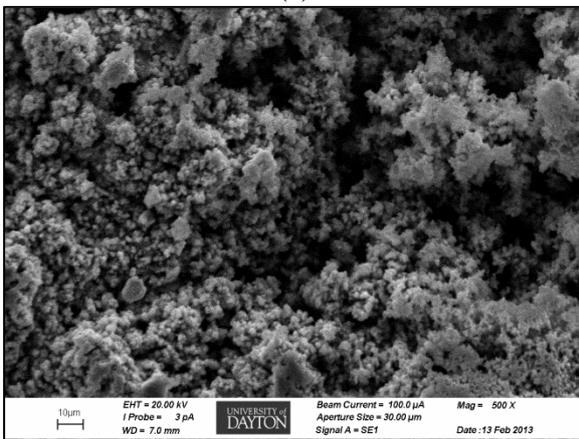
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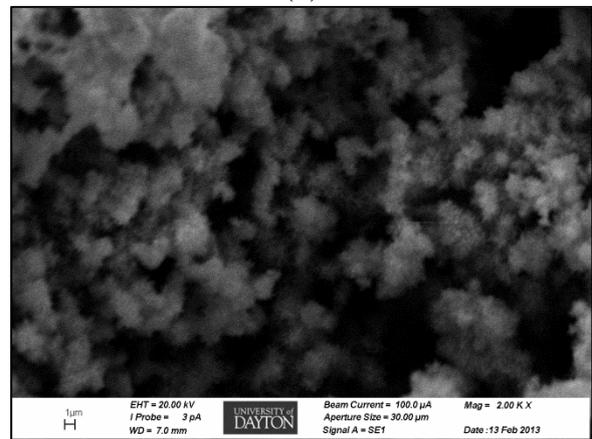
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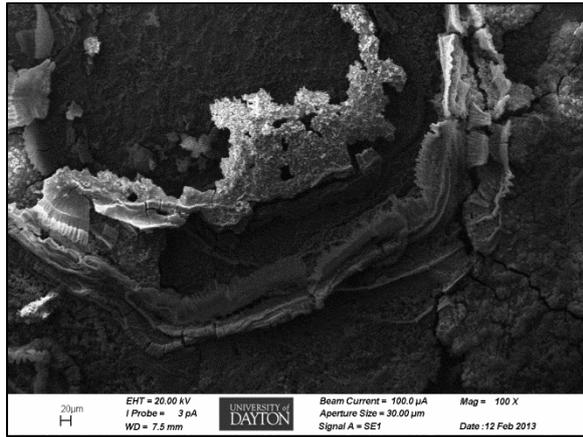


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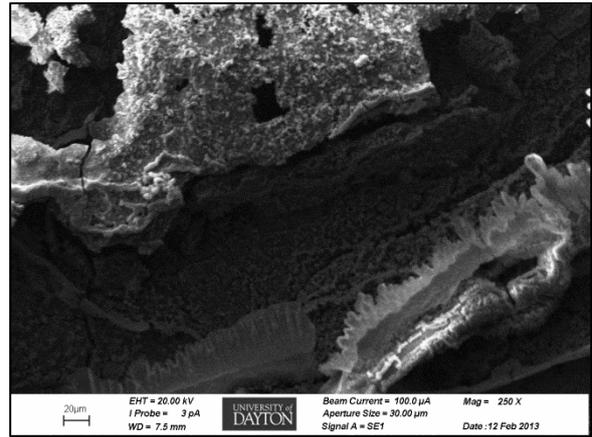


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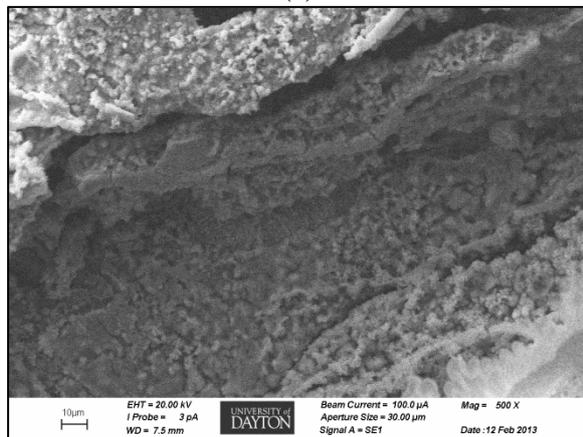
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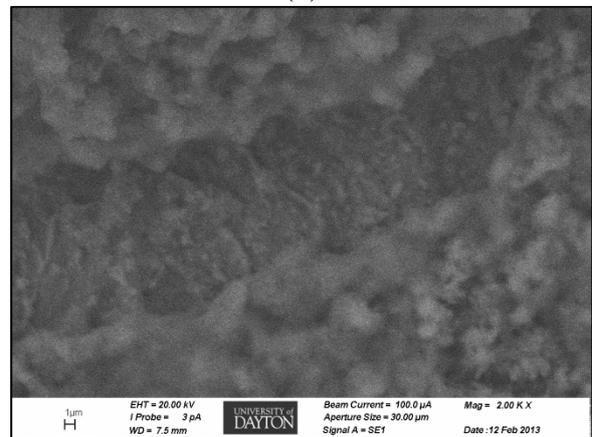
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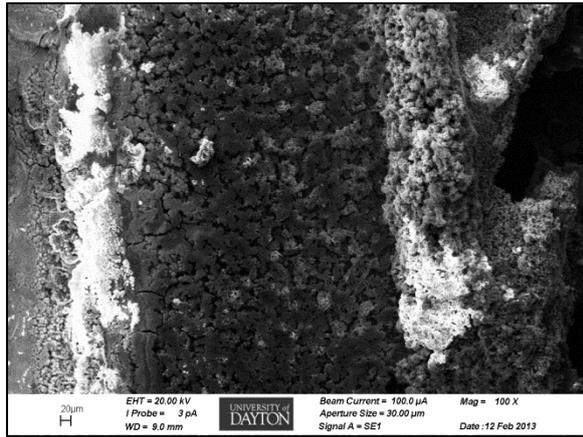


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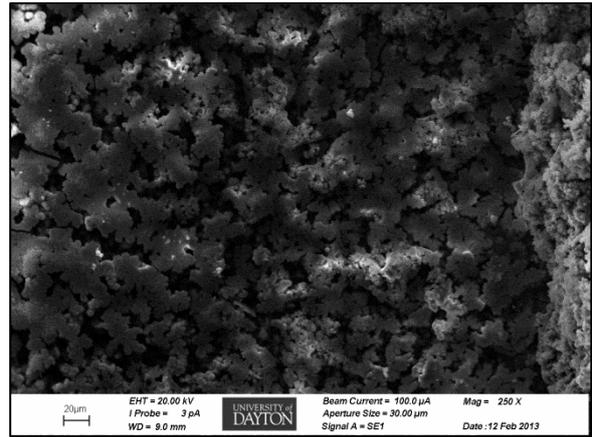


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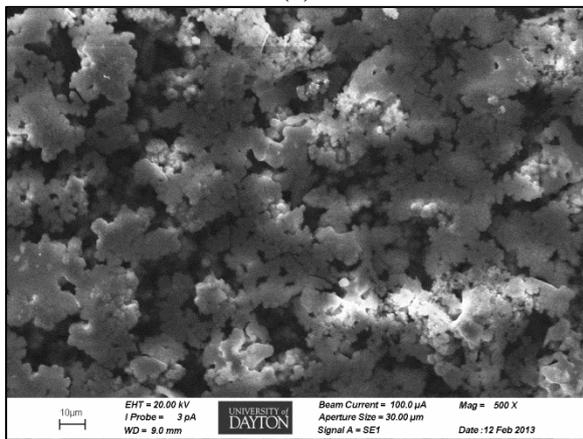
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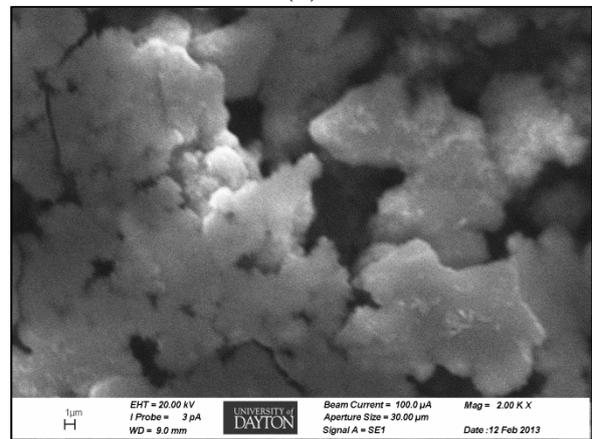
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(b)



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**Appendix O**  
Scanning Electron Microscopy Images  
Bare Coupons  
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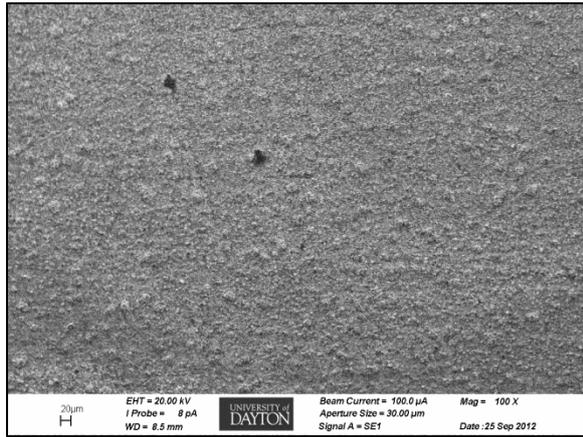
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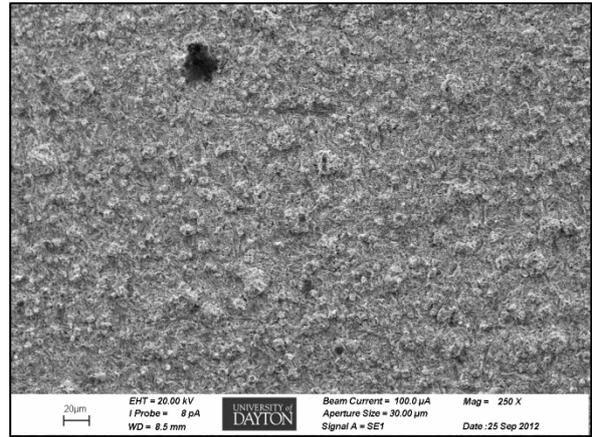
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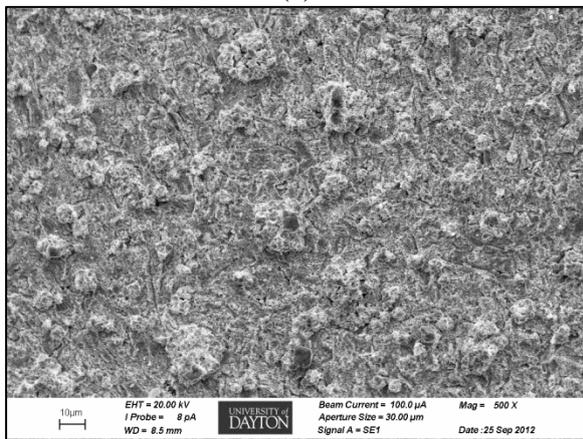
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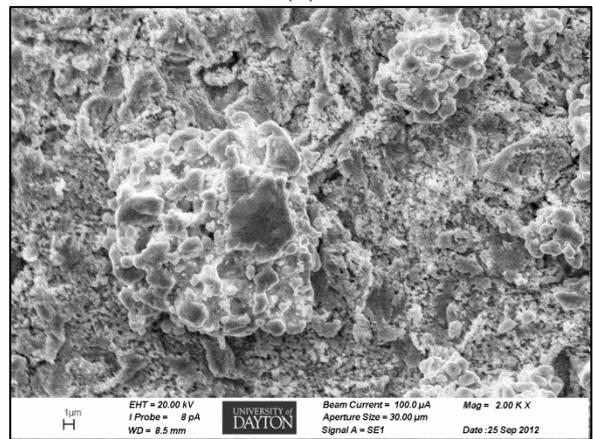
(a)



(b)



(c)



(d)

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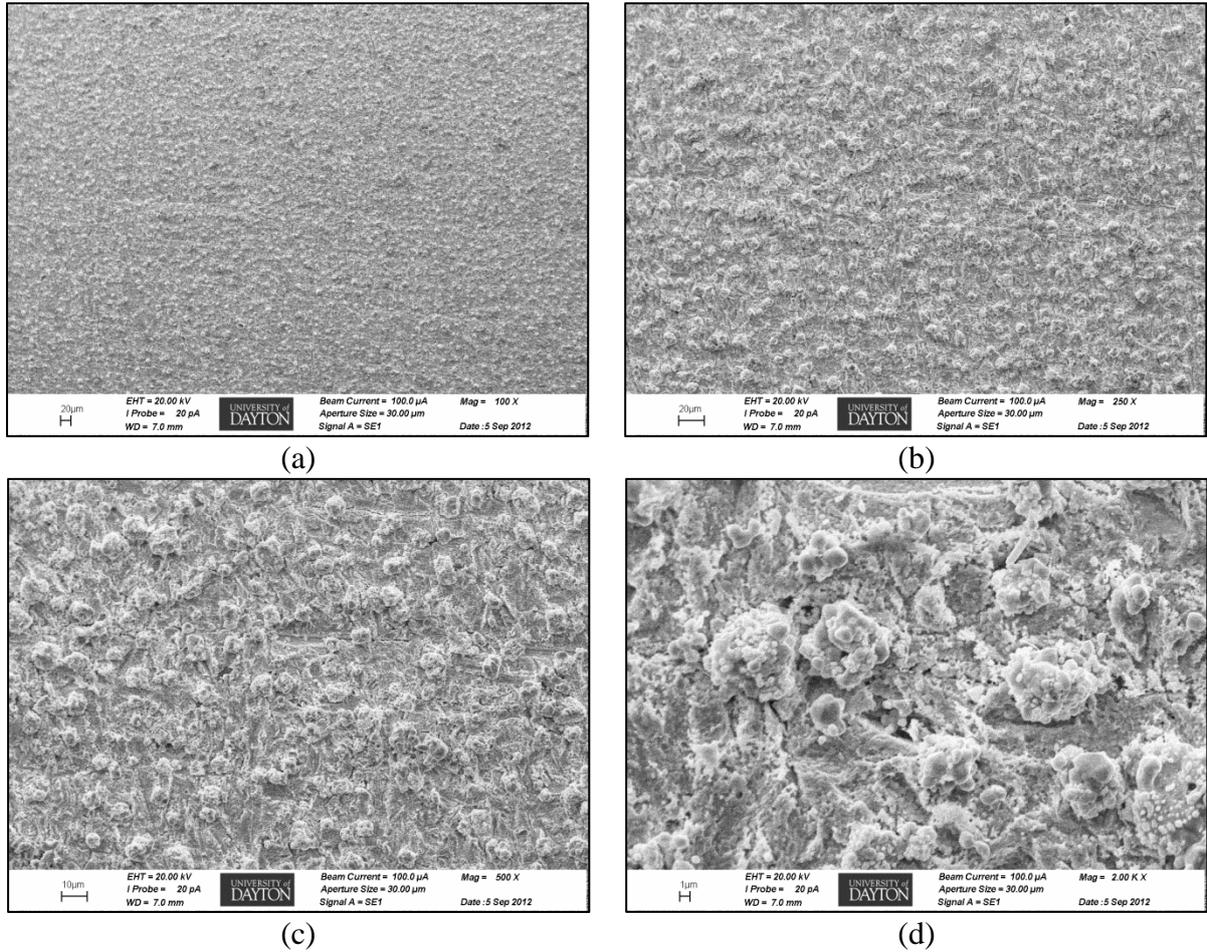


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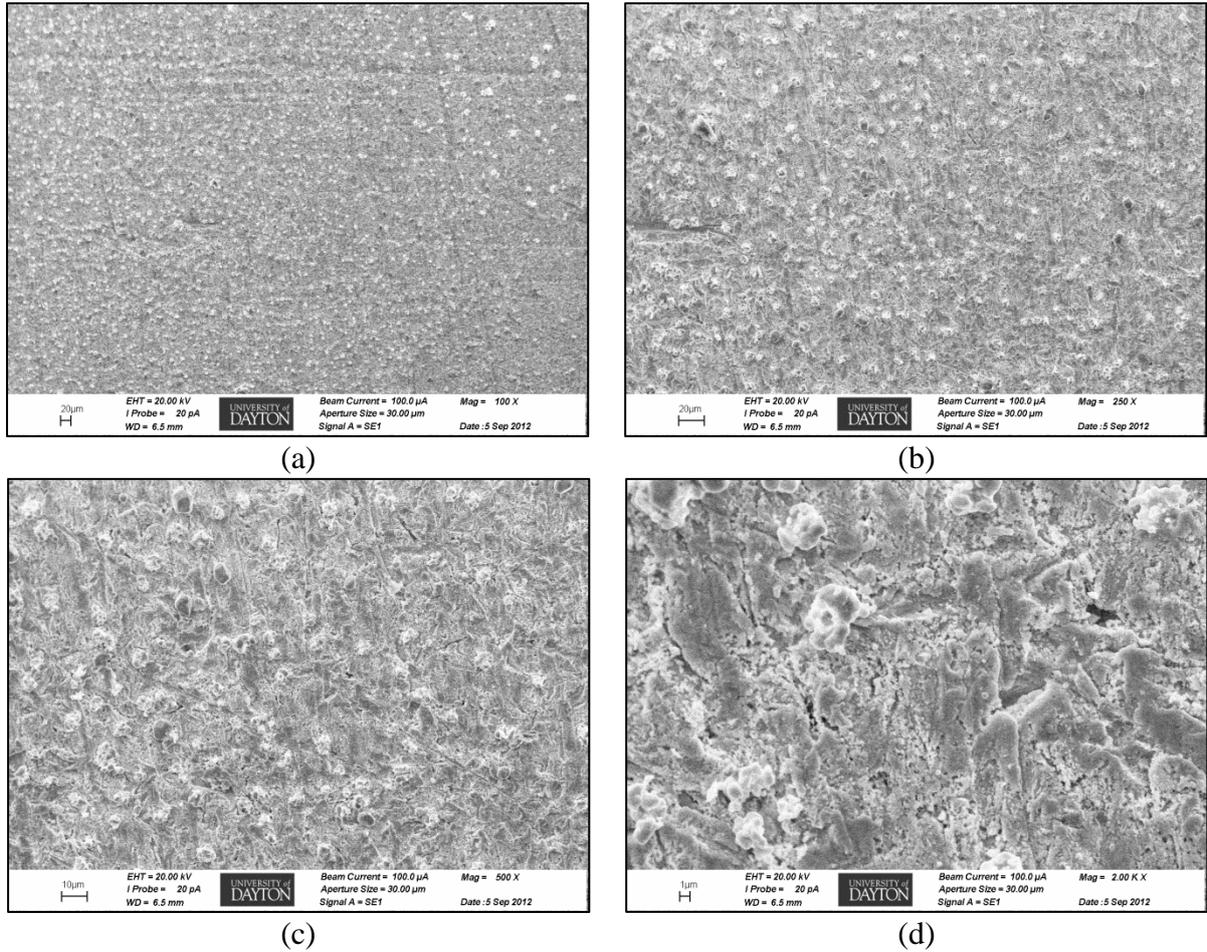


Figure O-3. SEM images of pure silver sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.

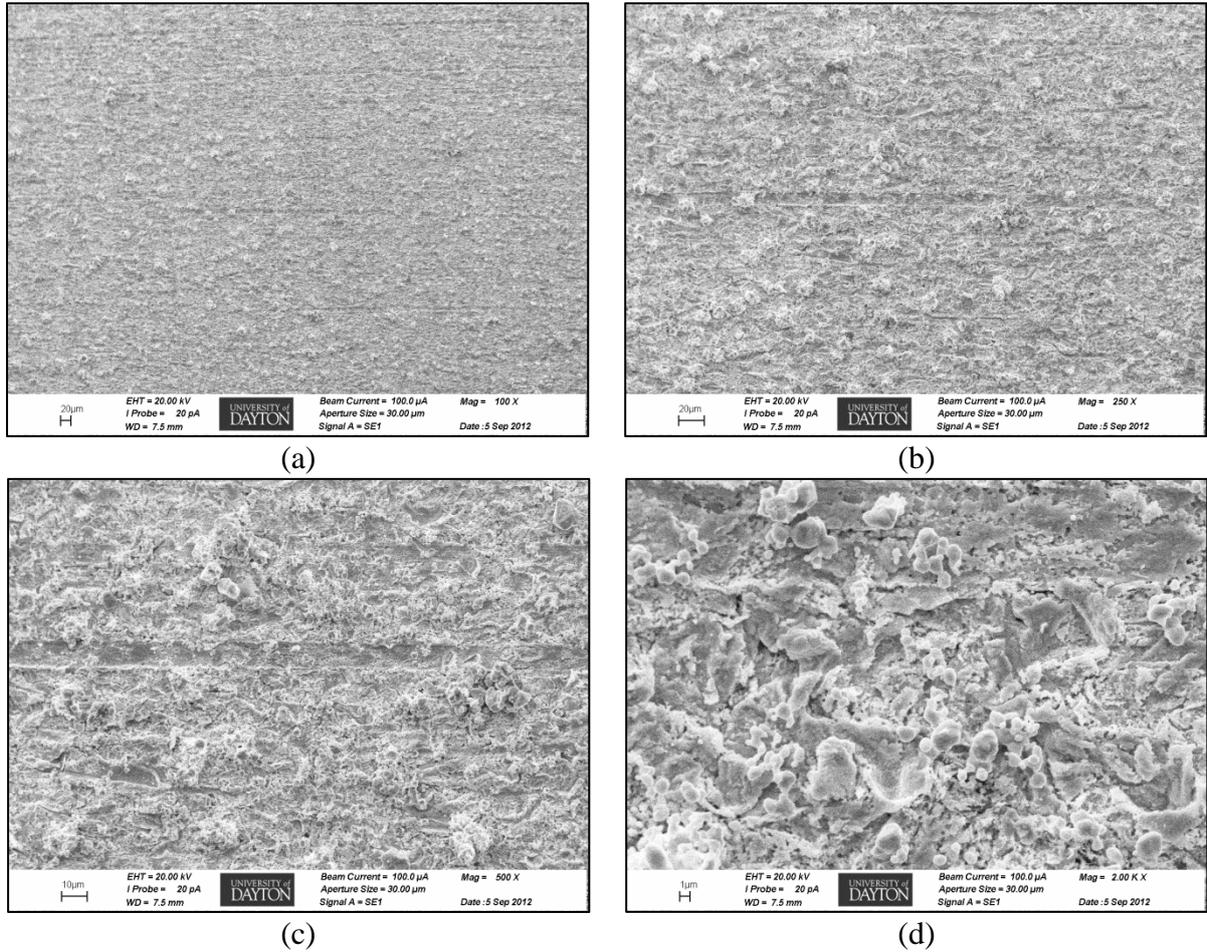


Figure O-4. SEM images of pure silver sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.

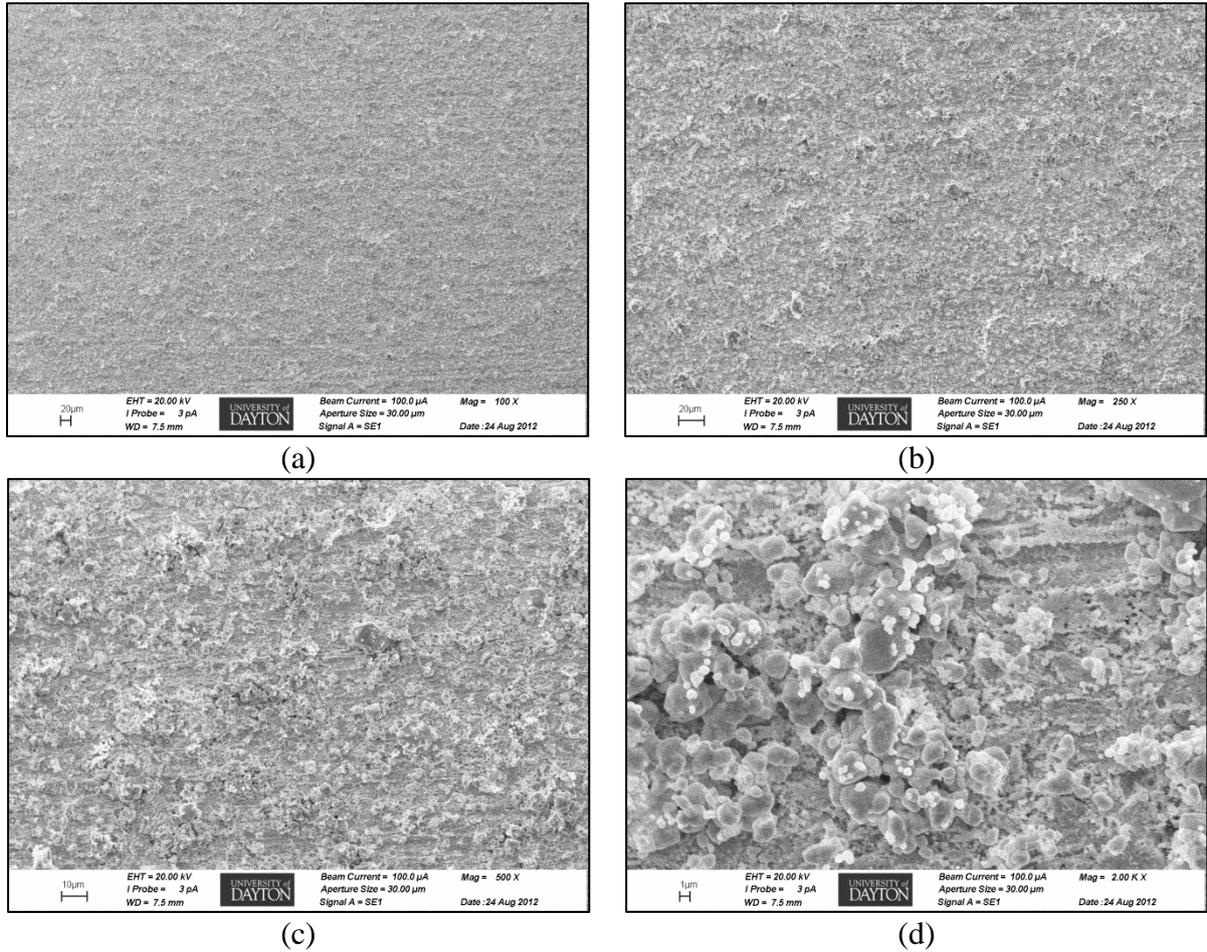
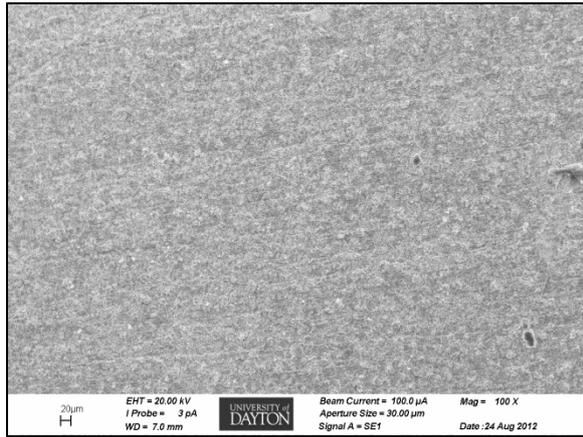
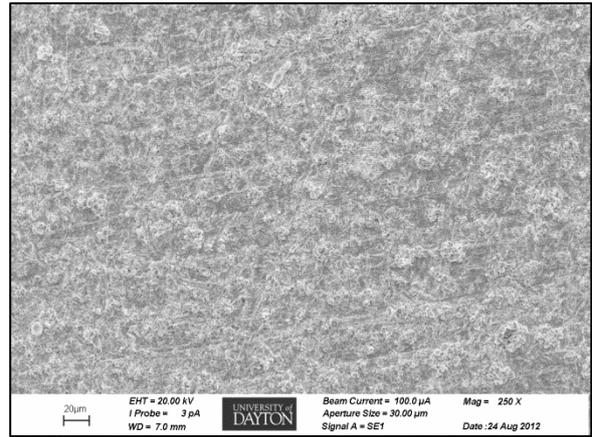


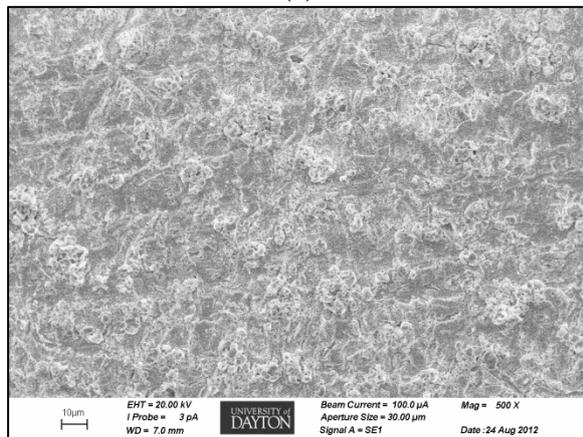
Figure O-5. SEM images of pure silver sample retrieved on 600 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



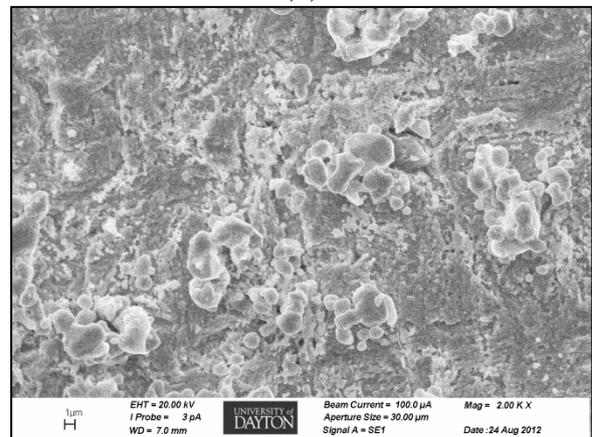
(a)



(b)

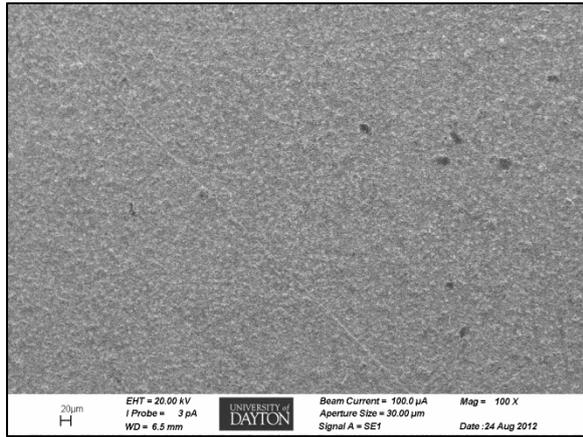


(c)

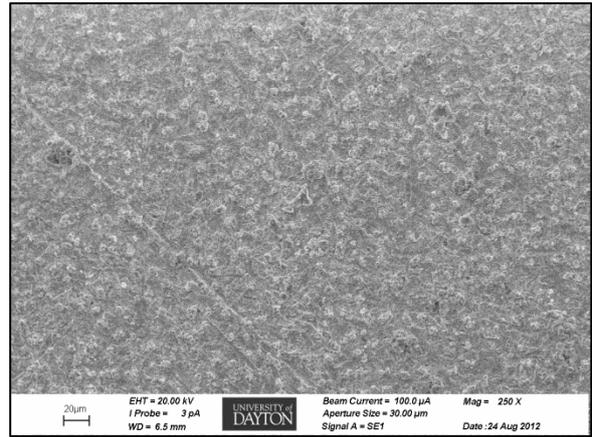


(d)

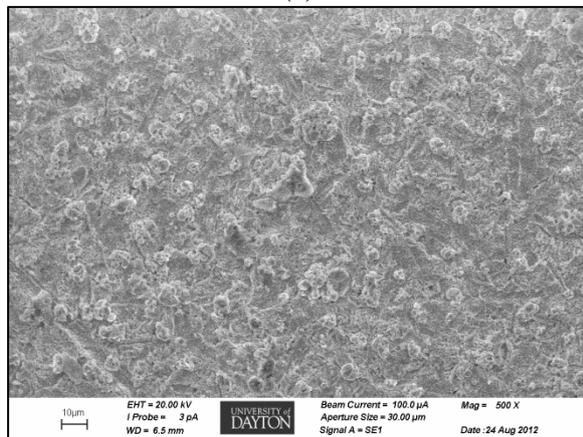
Figure O-6. SEM images of pure silver sample retrieved on 500 hours exposure from low UV ( $0.1 \text{ W/m}^2$ ) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



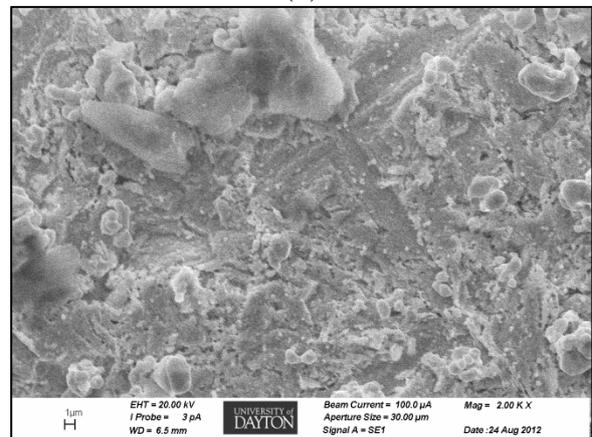
(a)



(b)

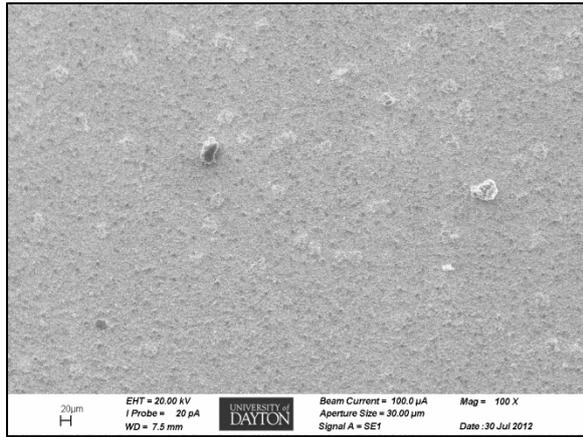


(c)

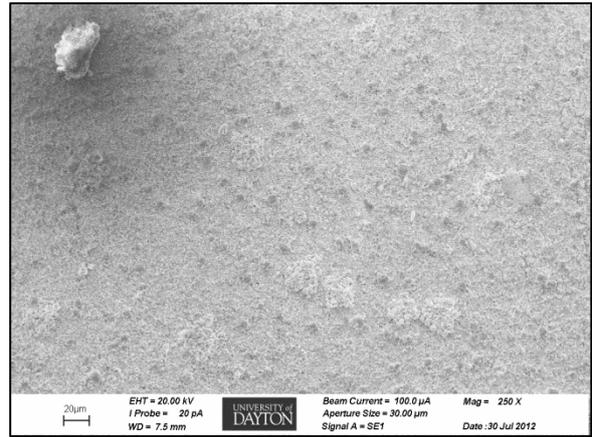


(d)

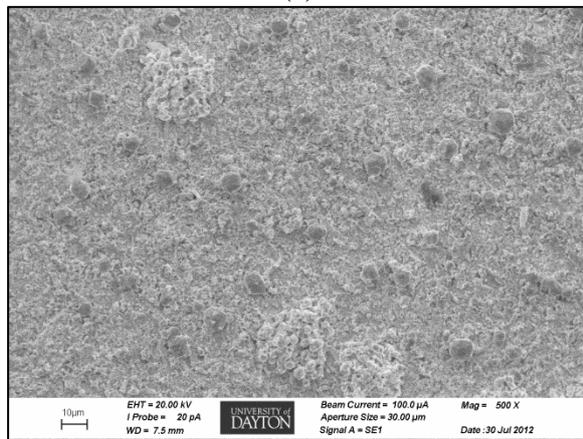
Figure O-7. SEM images of pure silver sample retrieved on 400 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



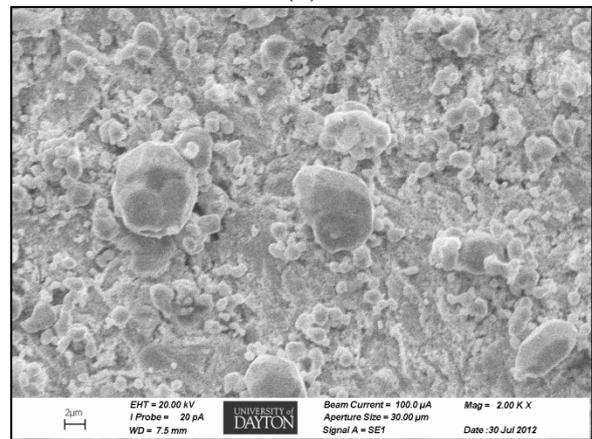
(a)



(b)



(c)



(d)

Figure O-8. SEM images of pure silver sample retrieved on 300 hours exposure from low UV ( $0.1 \text{ W/m}^2$ ) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 2000X magnification.

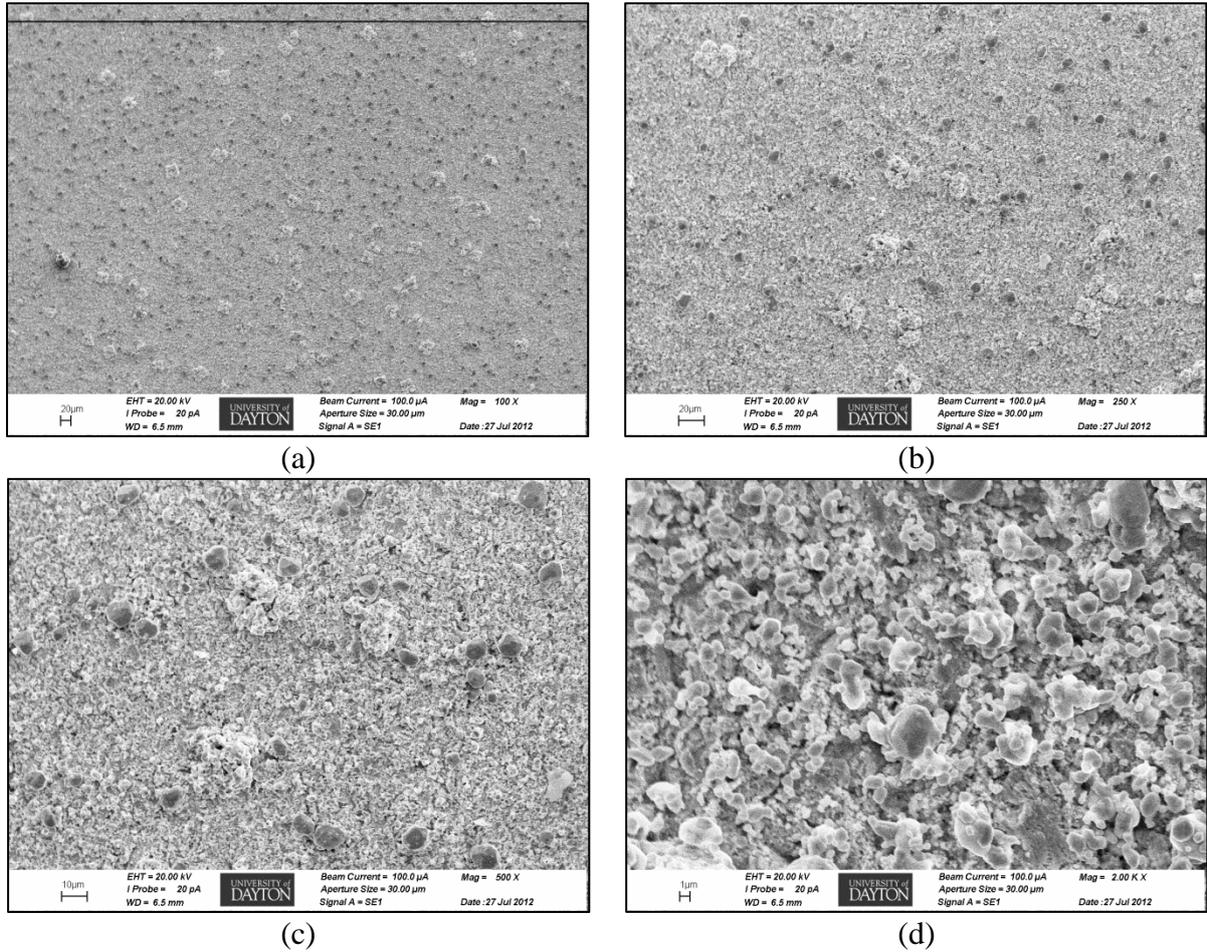
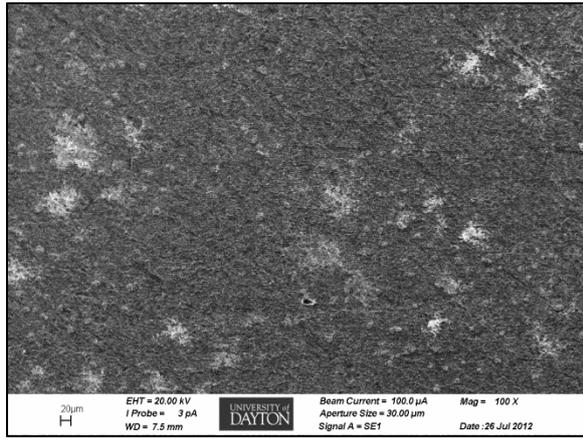
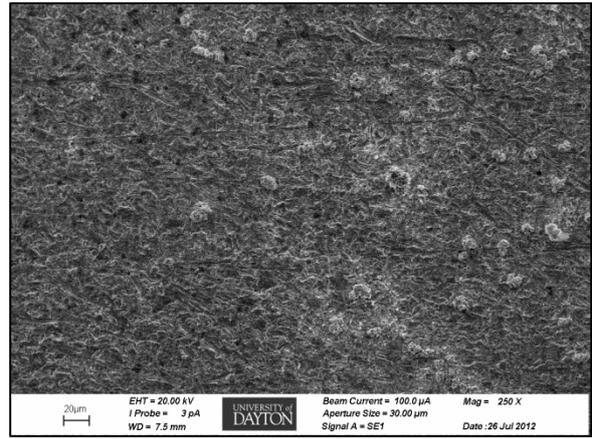


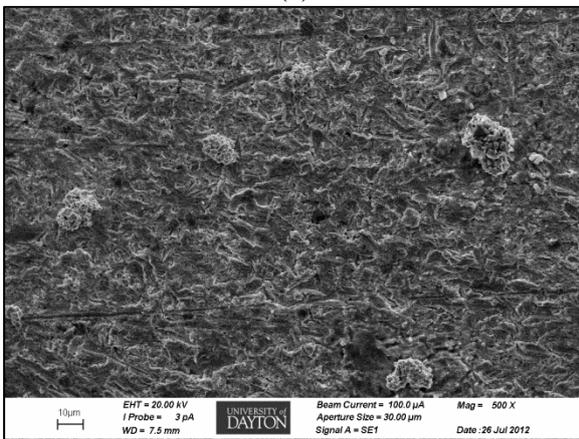
Figure O-9. SEM images of pure silver sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 1000X magnification.



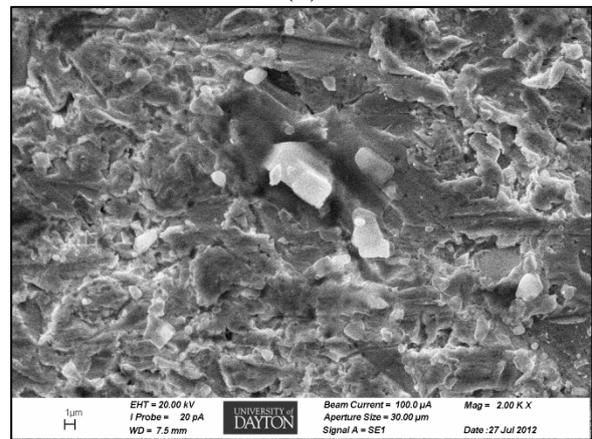
(a)



(b)

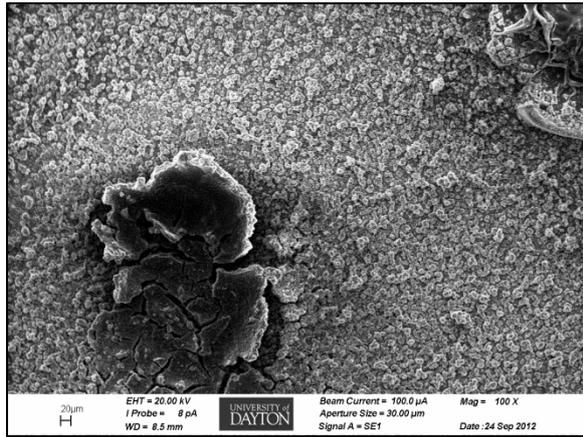


(c)

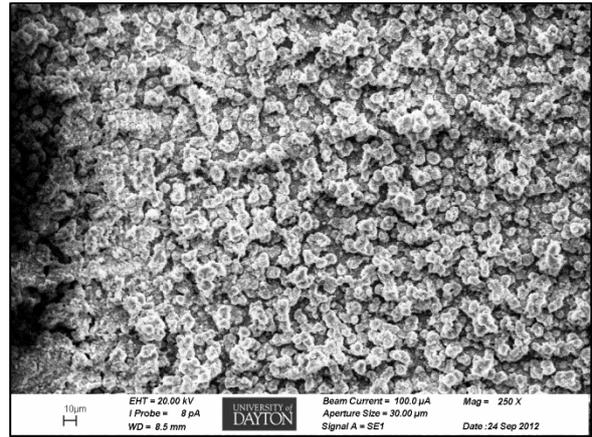


(d)

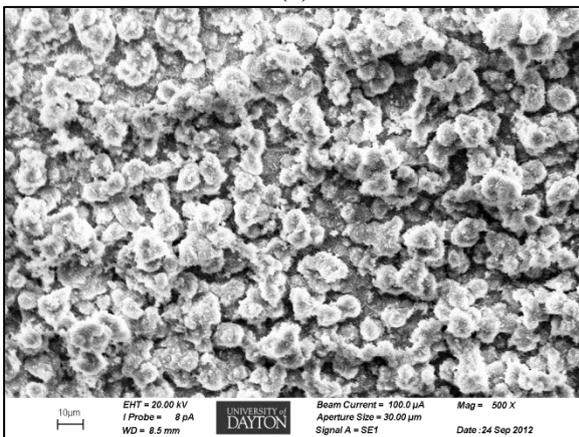
Figure O-10. SEM images of pure silver sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 1000X magnification.



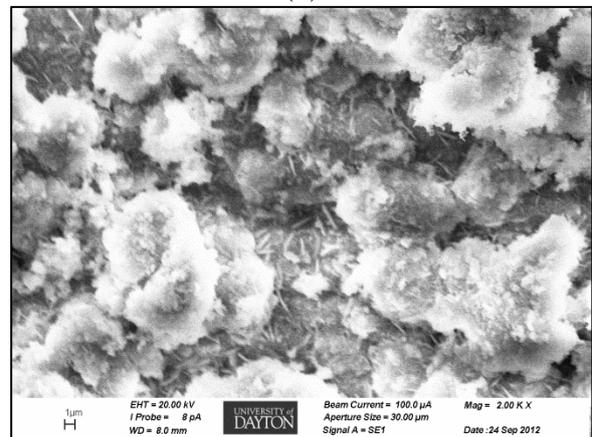
(a)



(b)

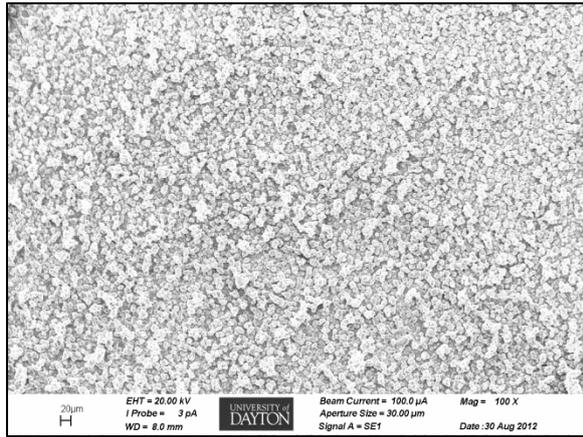


(c)

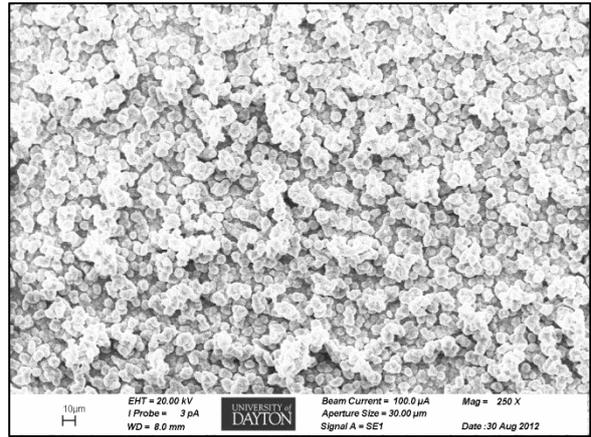


(d)

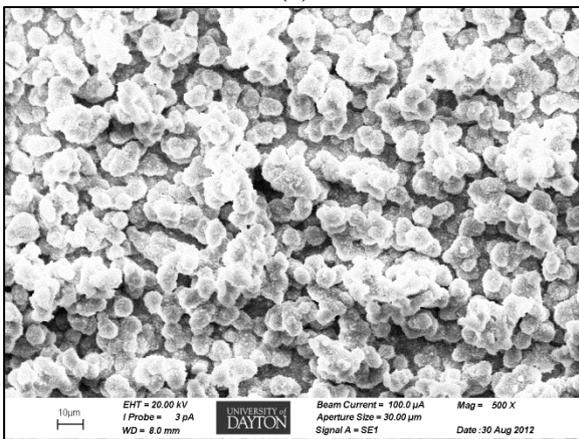
Figure O-11. SEM images of aluminum alloy 7075 sample retrieved on 1000 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



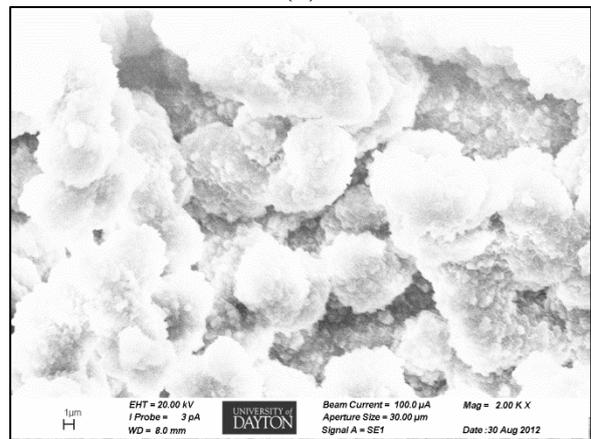
(a)



(b)

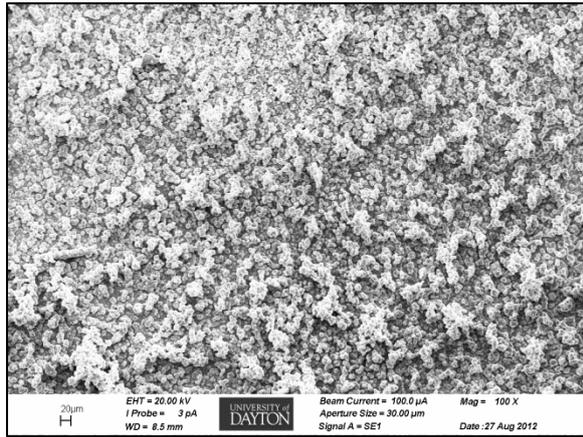


(c)

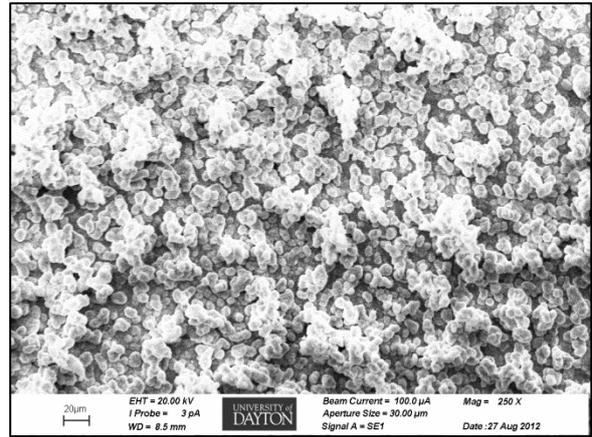


(d)

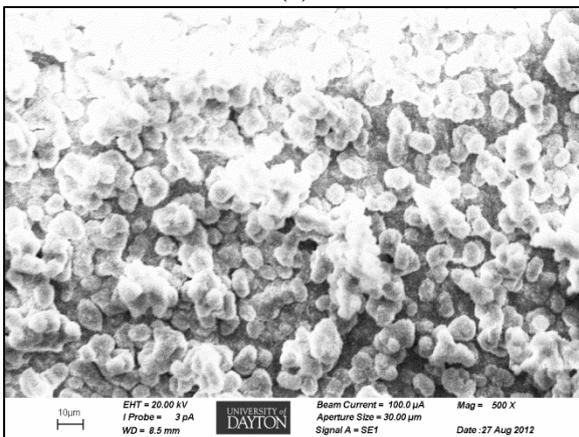
Figure O-12. SEM images of aluminum alloy 7075 sample retrieved on 900 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



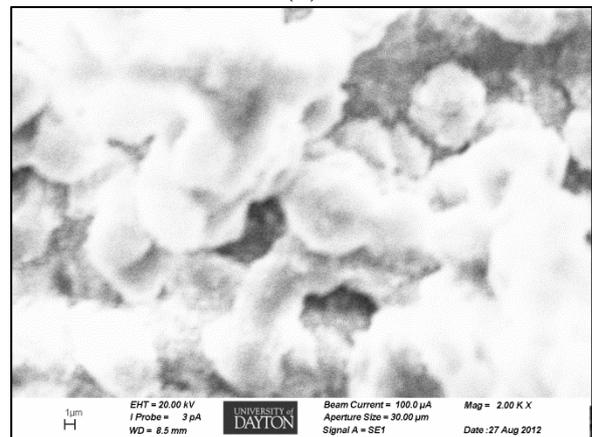
(a)



(b)

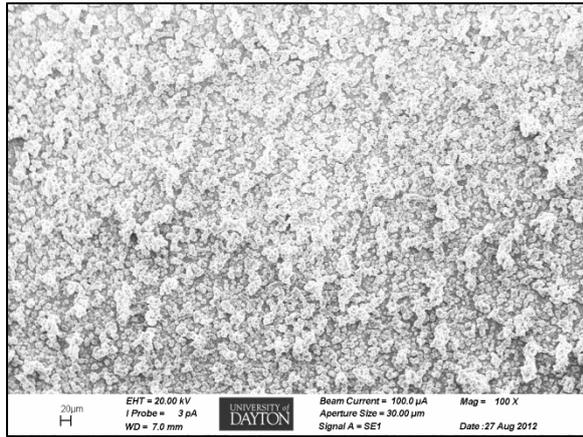


(c)

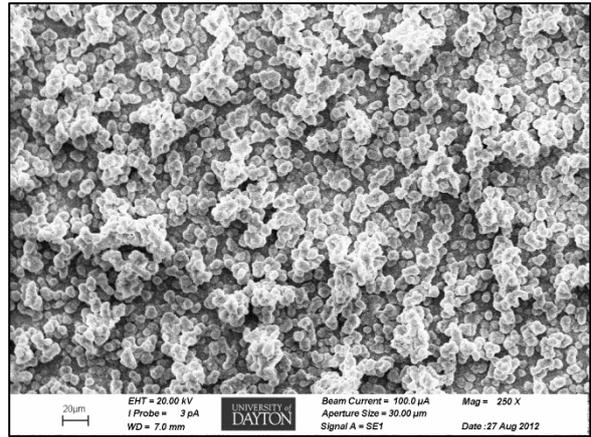


(d)

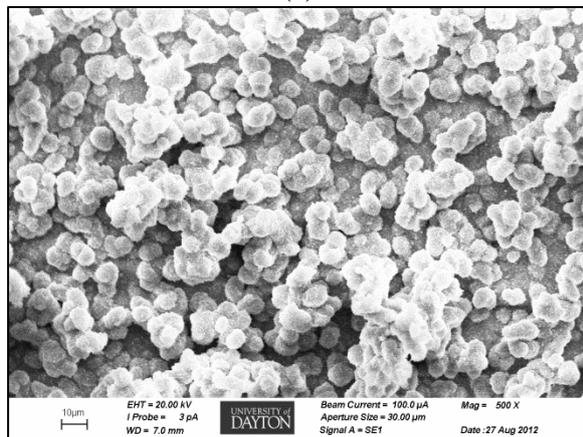
Figure O-13. SEM images of aluminum alloy 7075 sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



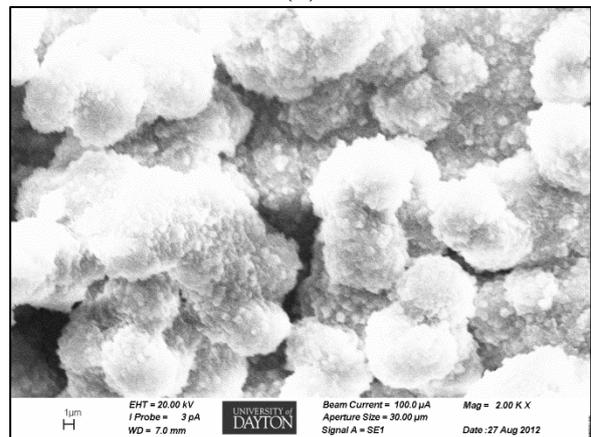
(a)



(b)

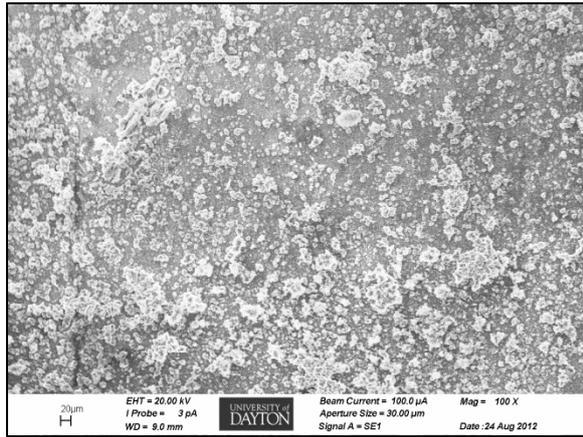


(c)

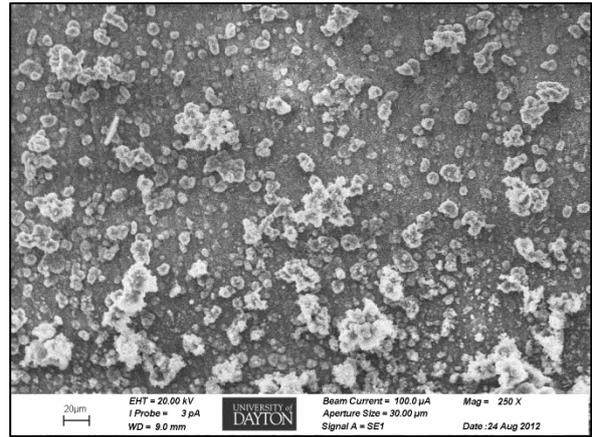


(d)

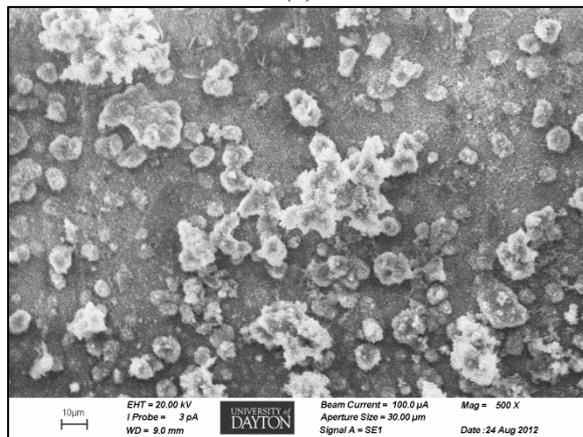
Figure O-14. SEM images of aluminum alloy 7075 sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



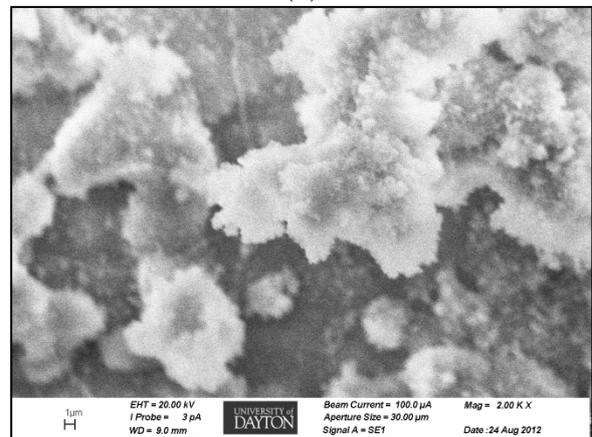
(a)



(b)

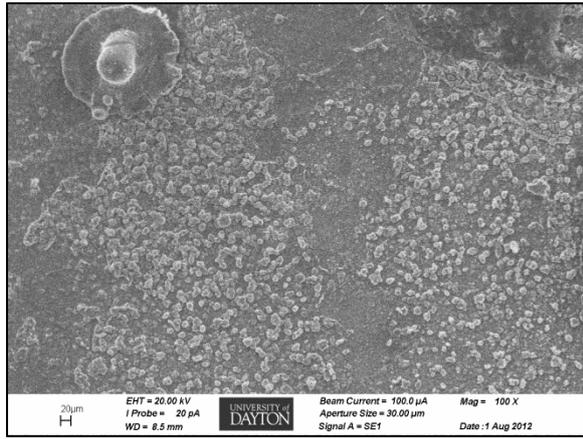


(c)

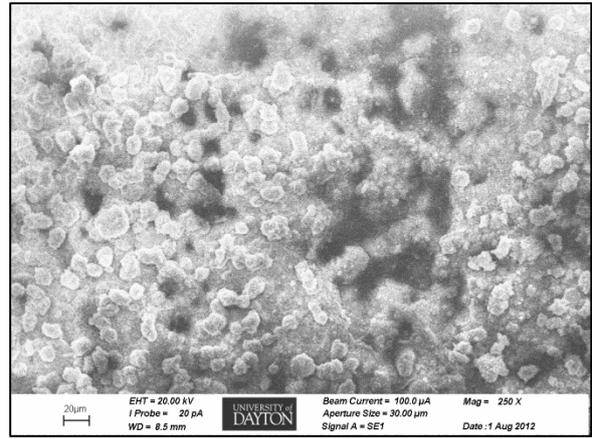


(d)

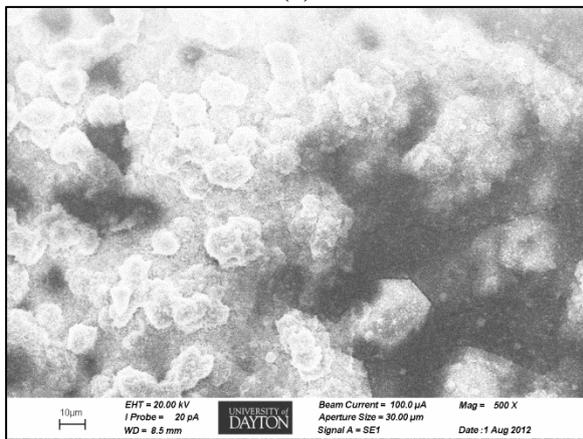
Figure O-15. SEM images of aluminum alloy 7075 sample retrieved on 600 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



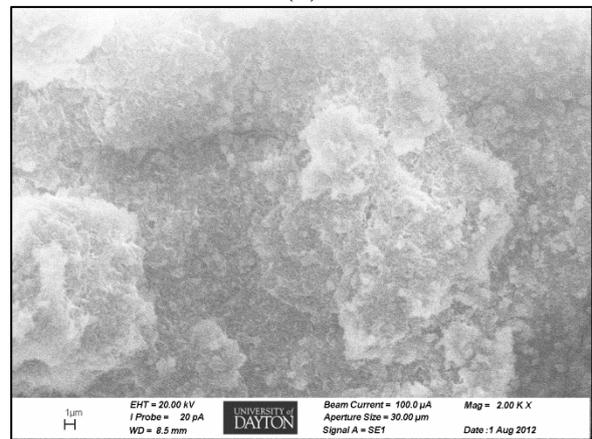
(a)



(b)

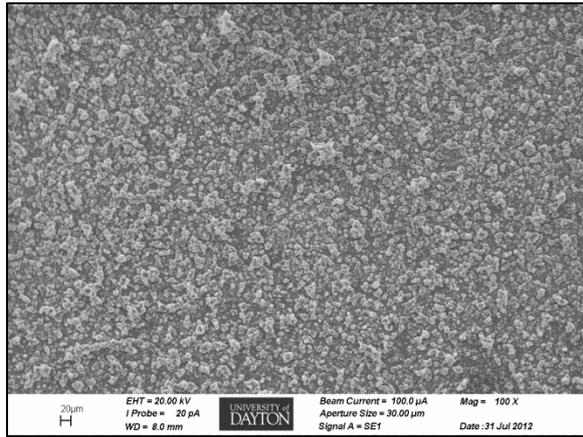


(c)

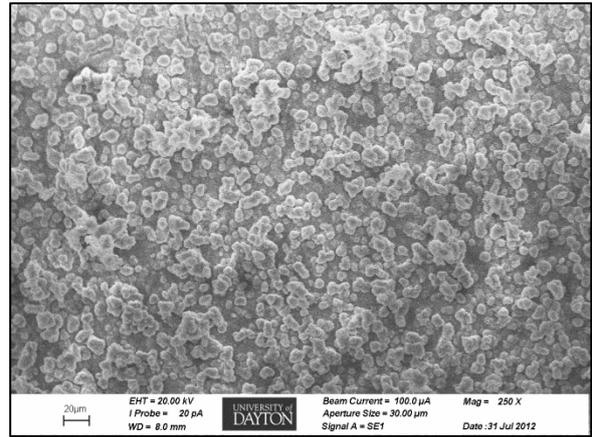


(d)

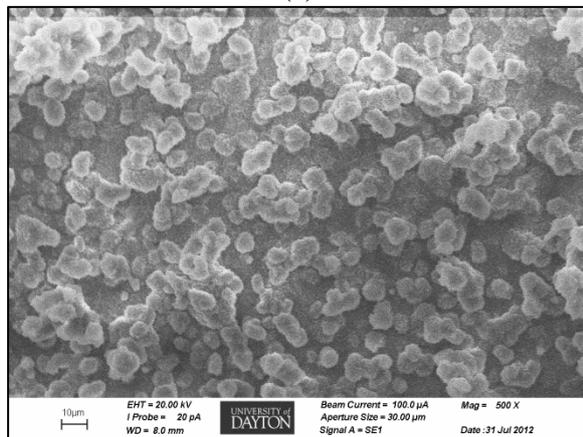
Figure O-16. SEM images of aluminum alloy 7075 sample retrieved on 500 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



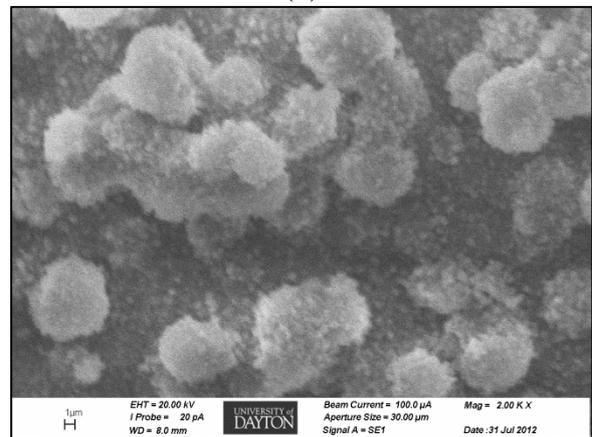
(a)



(b)

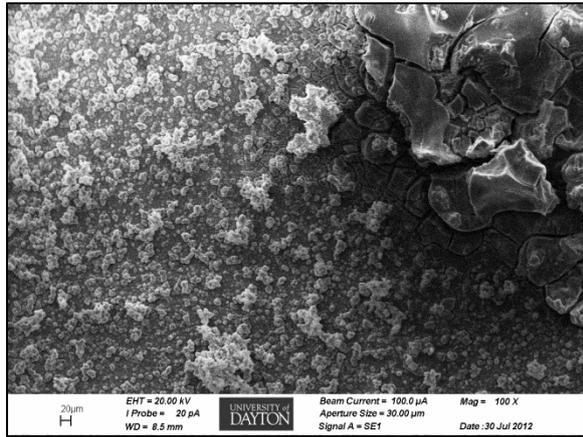


(c)

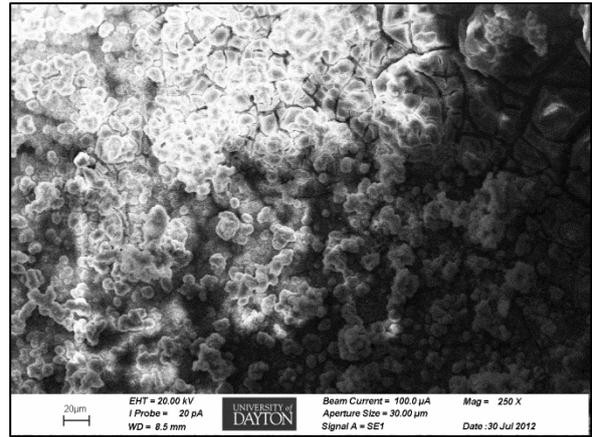


(d)

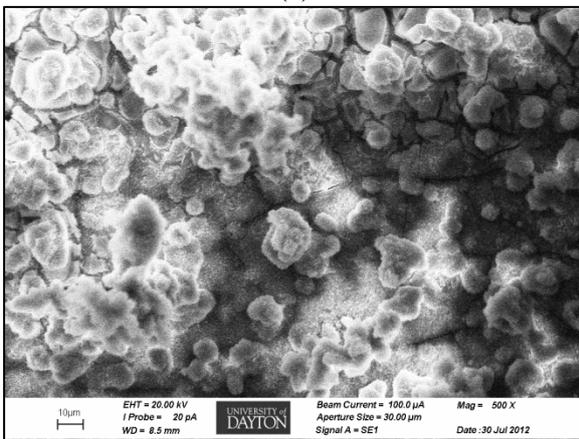
Figure O-17. SEM images of aluminum alloy 7075 sample retrieved on 400 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 100X magnification



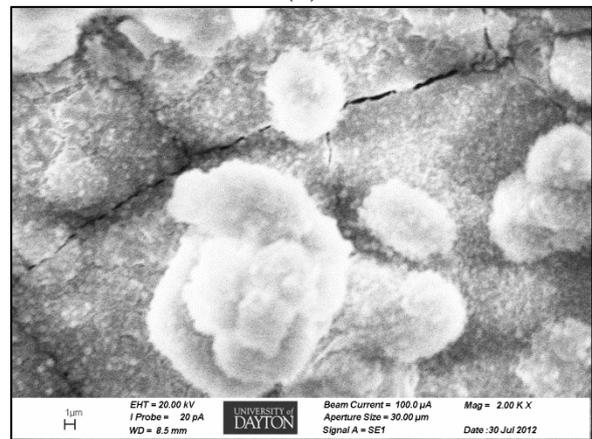
(a)



(b)

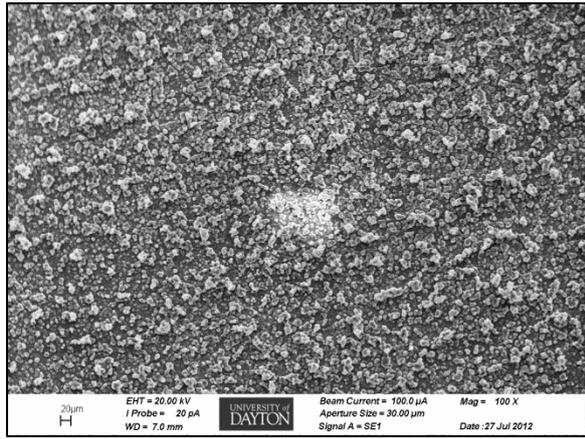


(c)

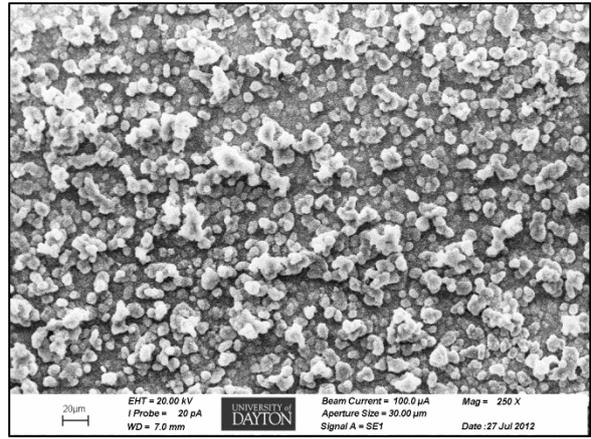


(d)

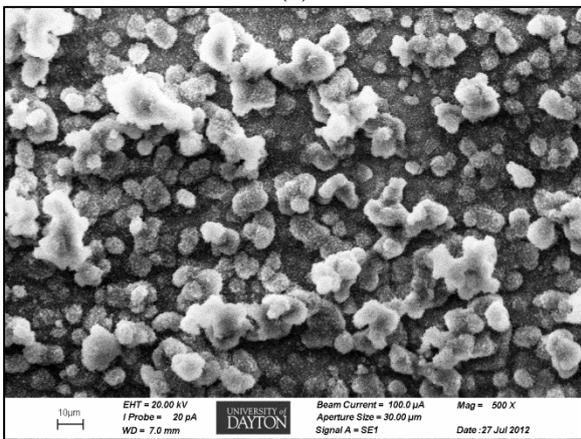
Figure O-18. SEM images of aluminum alloy 7075 sample retrieved on 300 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 1000X magnification.



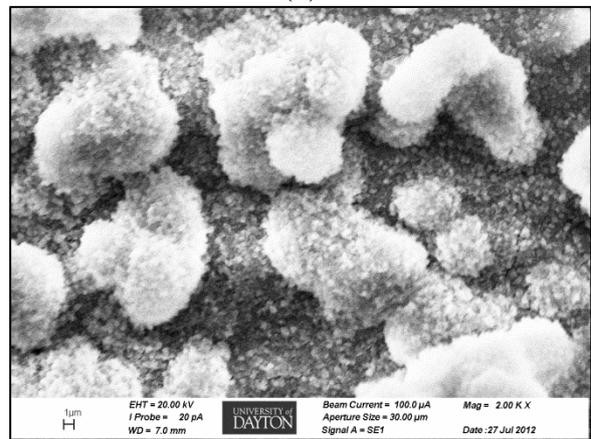
(a)



(b)

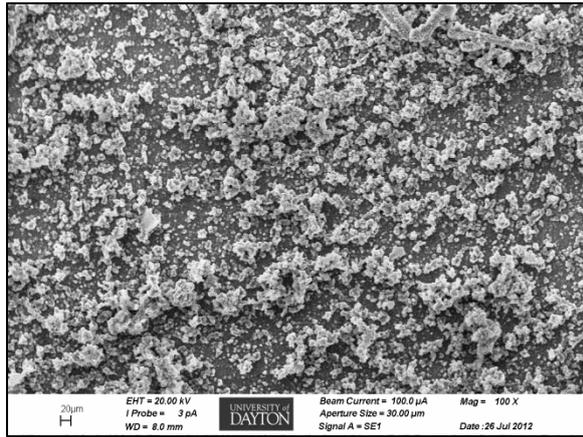


(c)

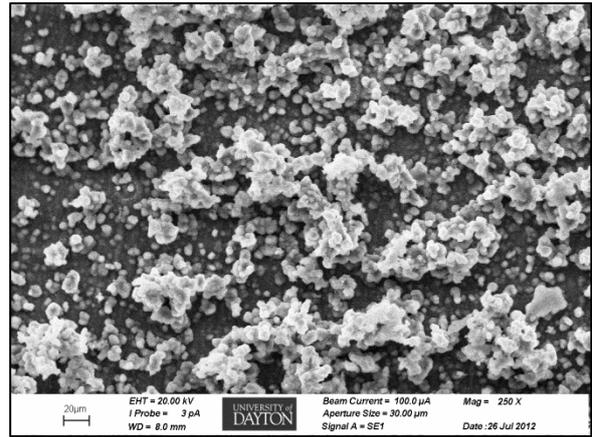


(d)

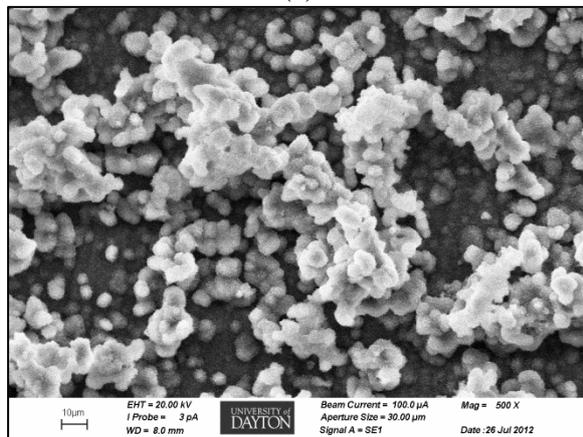
Figure O-19. SEM images of aluminum alloy 7075 sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 2000X magnification



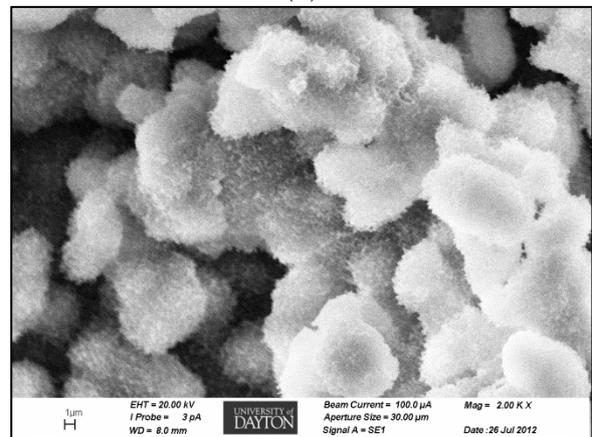
(a)



(b)

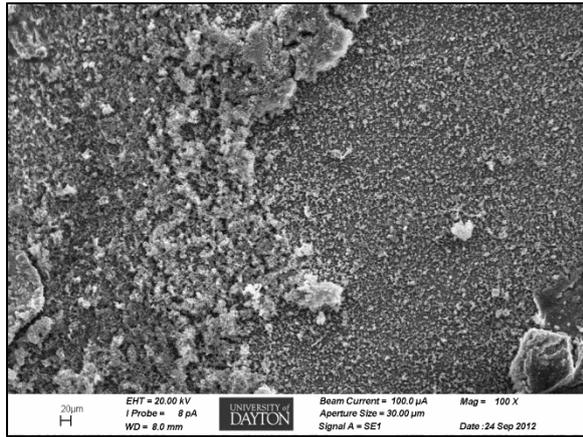


(c)

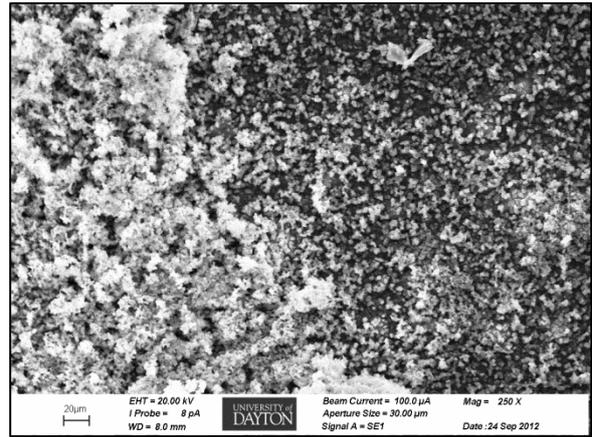


(d)

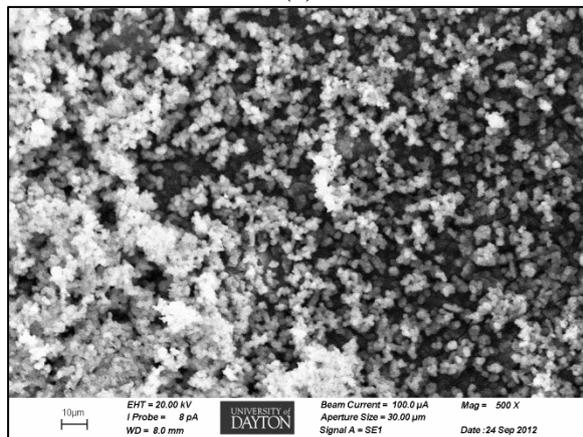
Figure O-20. SEM images of aluminum alloy 7075 sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



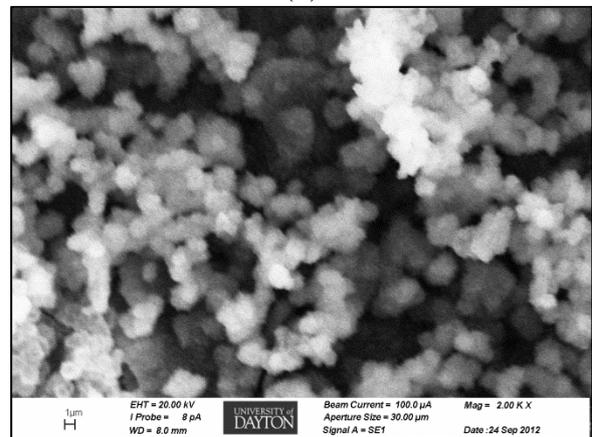
(a)



(b)

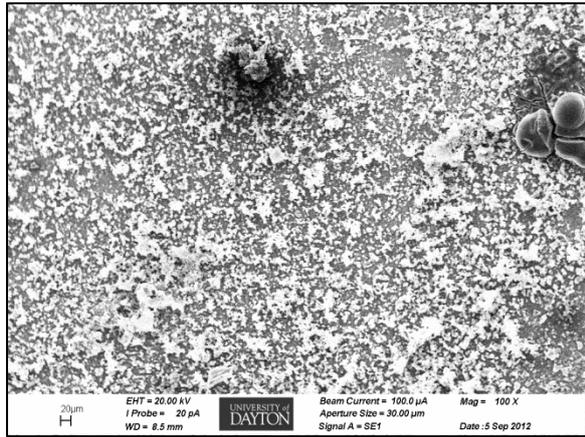


(c)

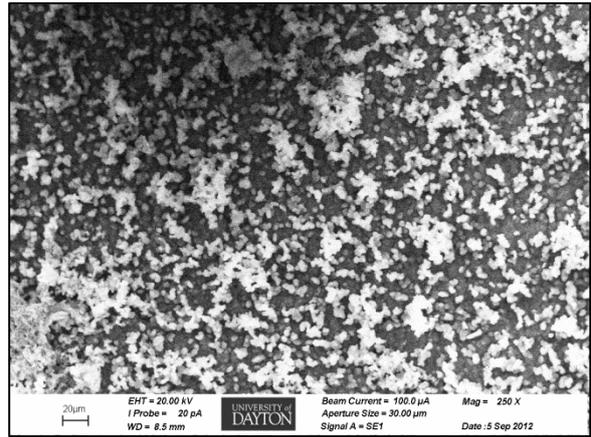


(d)

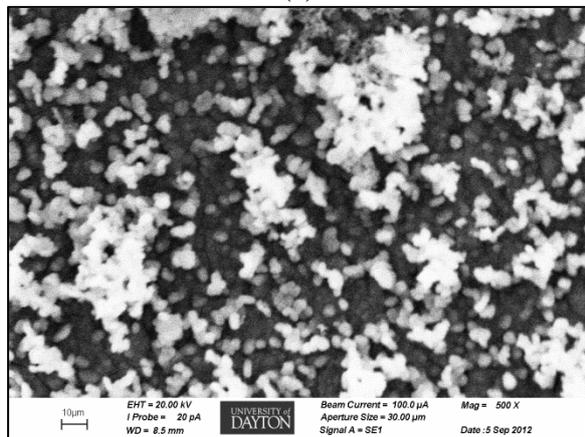
Figure O-21. SEM images of aluminum alloy 6061 sample retrieved on 1000 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



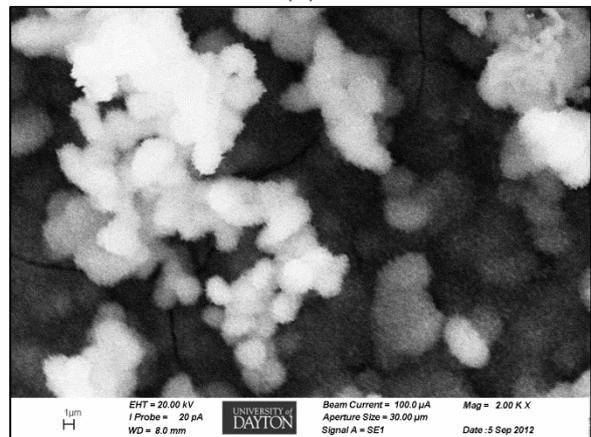
(a)



(b)

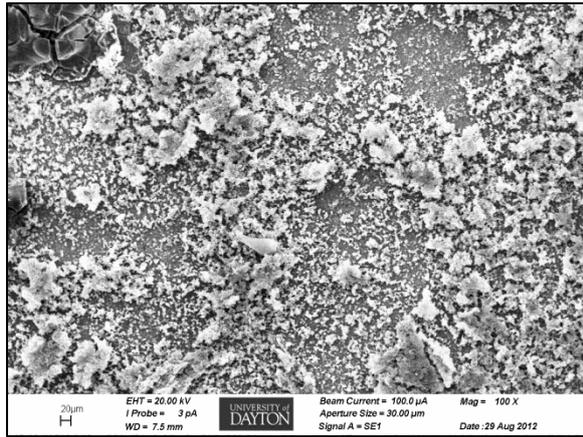


(c)

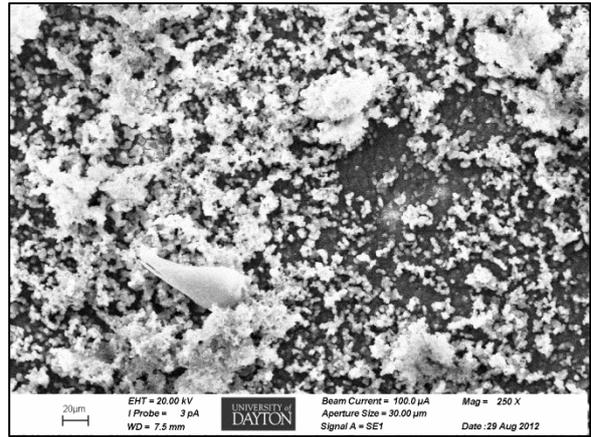


(d)

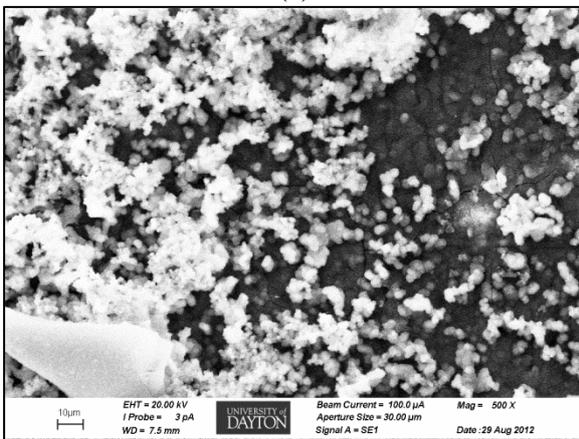
Figure O-22. SEM images of aluminum alloy 6061 sample retrieved on 900 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



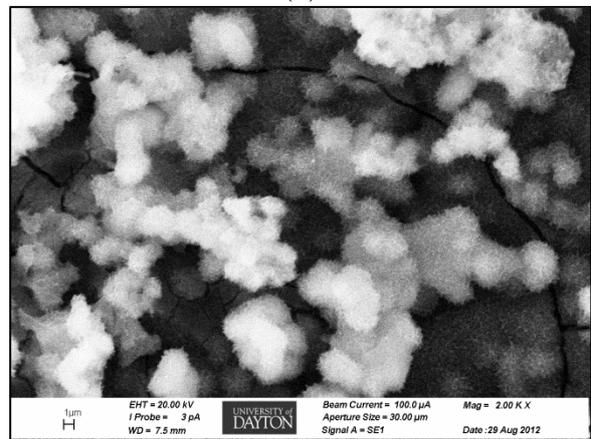
(a)



(b)

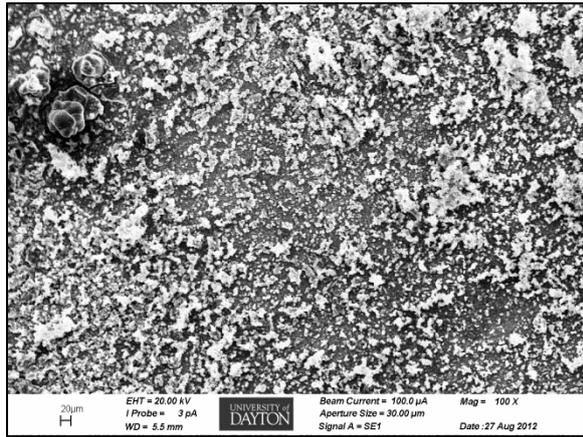


(c)

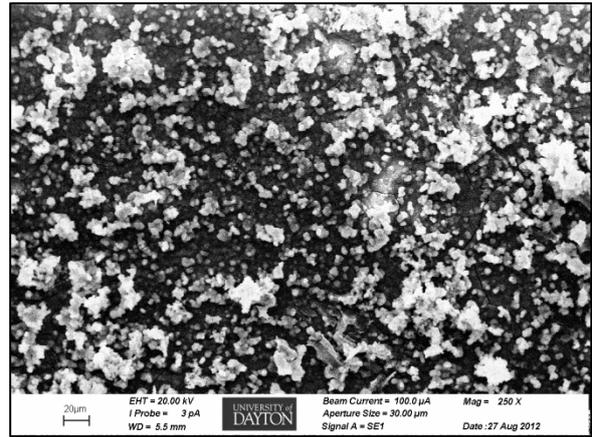


(d)

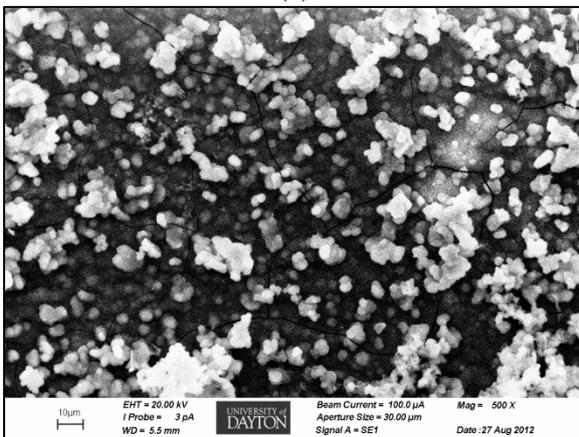
Figure O-23. SEM images of aluminum alloy 6061 sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



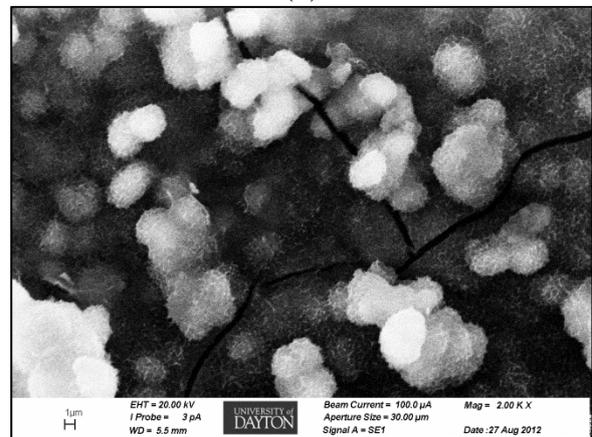
(a)



(b)

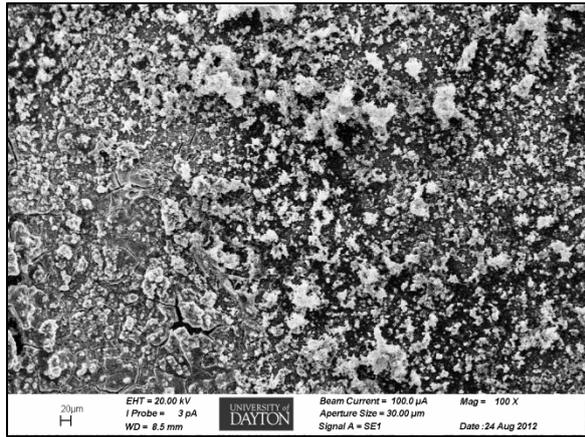


(c)

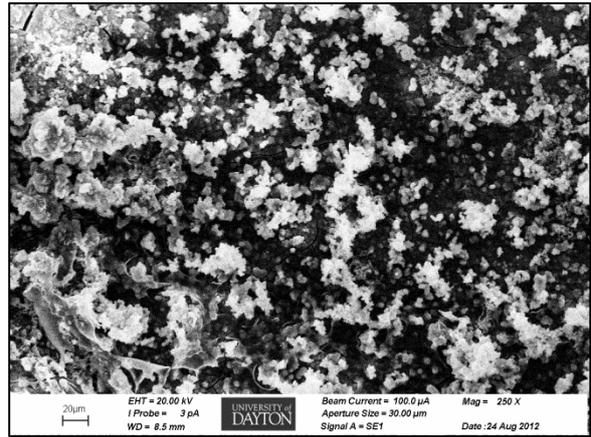


(d)

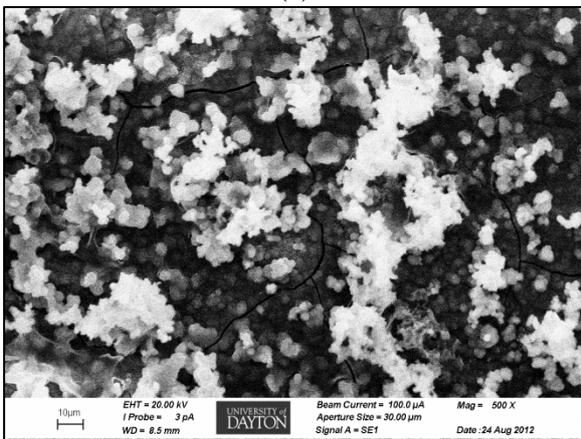
Figure O-24. SEM images of aluminum alloy 6061 sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



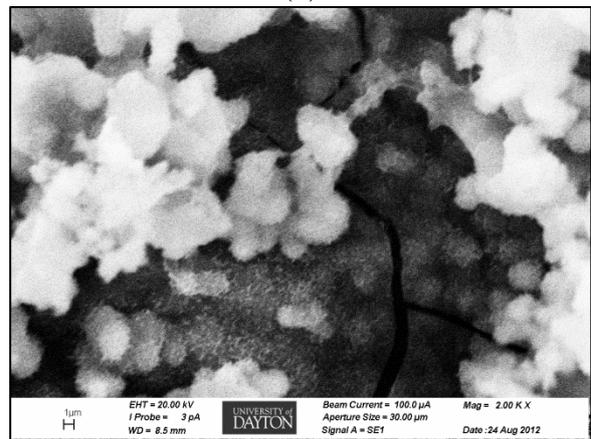
(a)



(b)

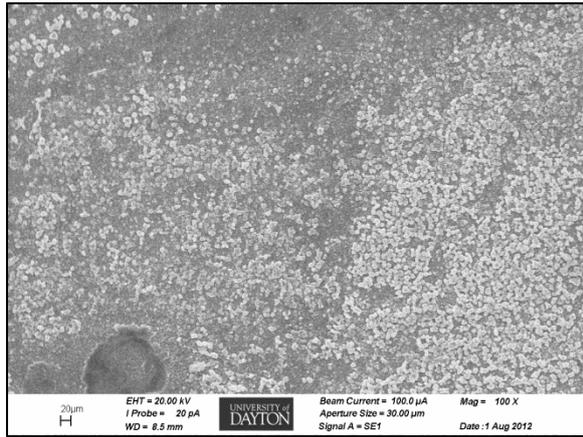


(c)

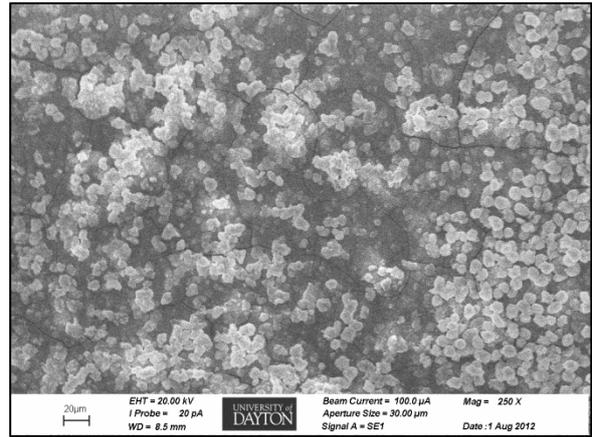


(d)

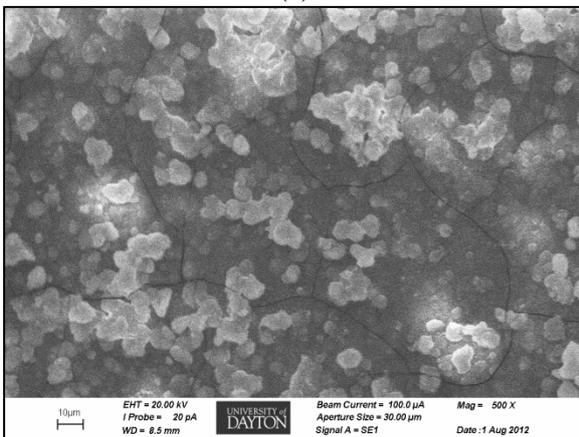
Figure O-25. SEM images of aluminum alloy 6061 sample retrieved on 600 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



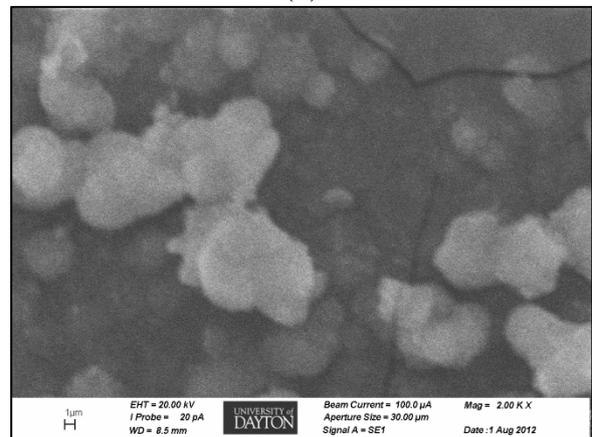
(a)



(b)

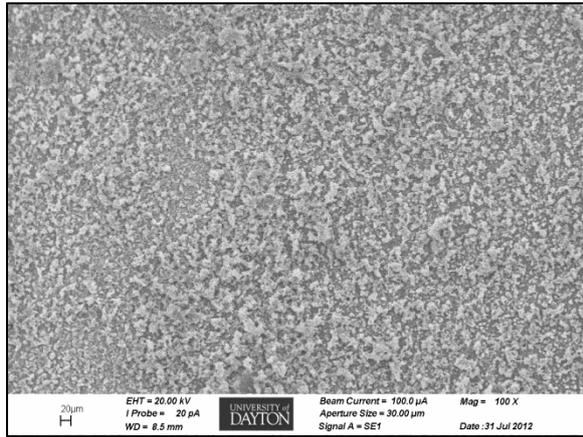


(c)

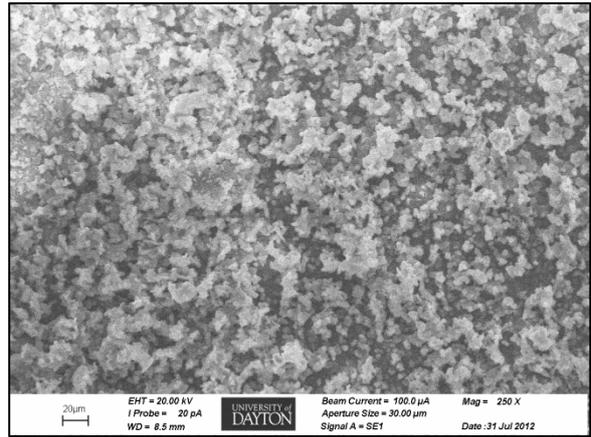


(d)

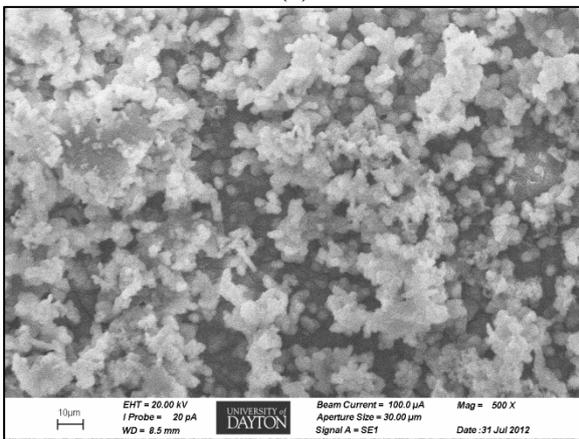
Figure O-26. SEM images of aluminum alloy 6061 sample retrieved on 500 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



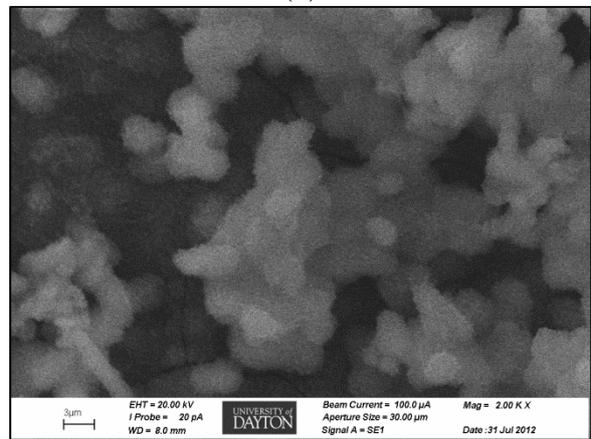
(a)



(b)

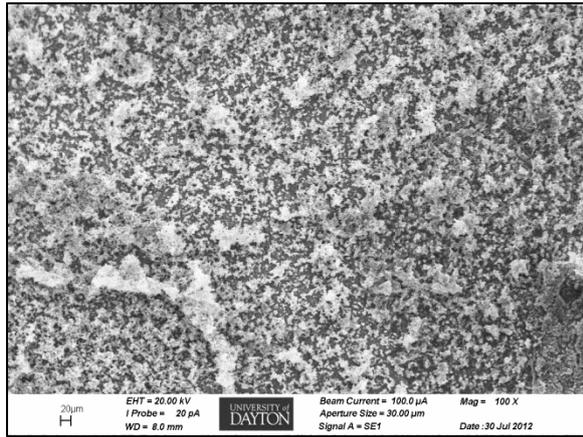


(c)

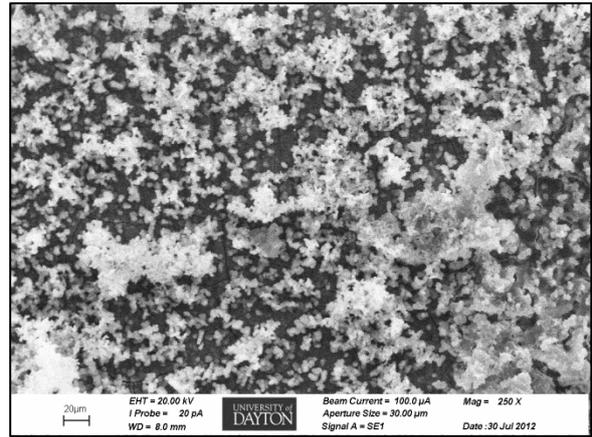


(d)

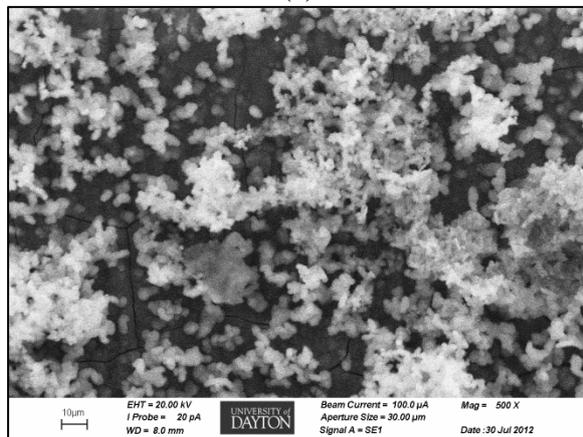
Figure O-27. SEM images of aluminum alloy 6061 sample retrieved on 400 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



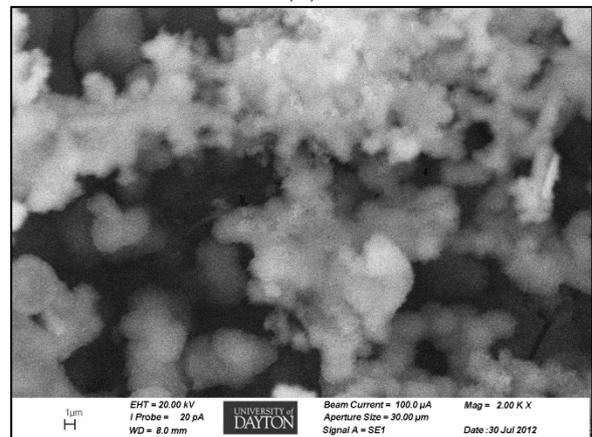
(a)



(b)

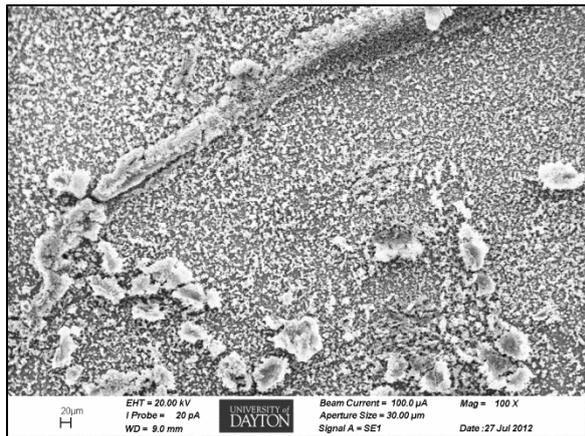


(c)

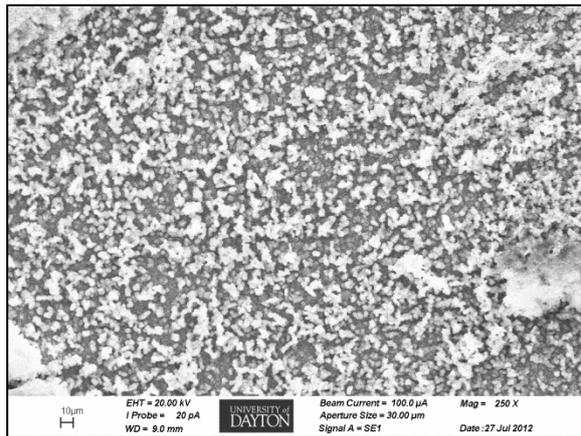


(d)

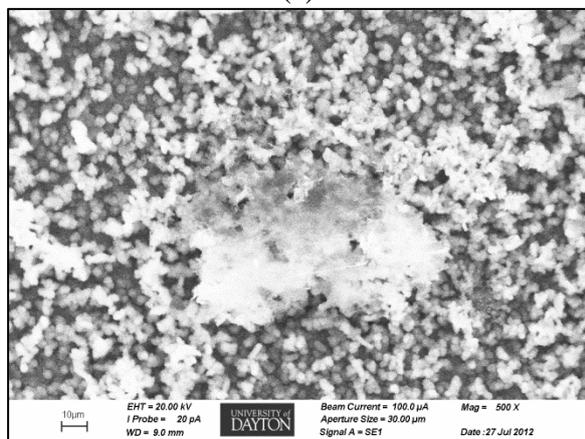
Figure O-28. SEM images of aluminum alloy 6061 sample retrieved on 300 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



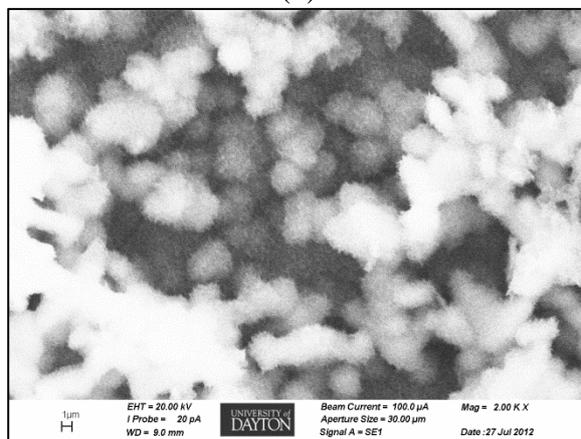
(a)



(b)

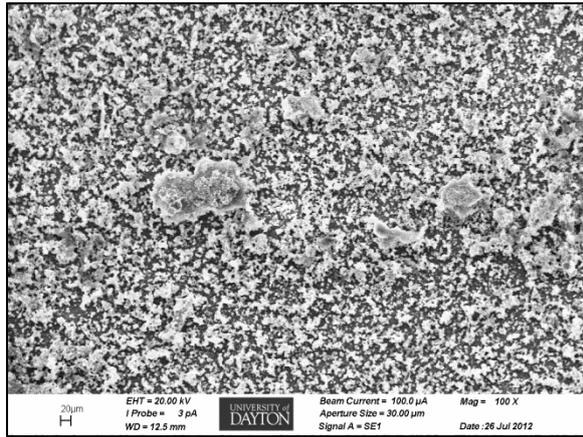


(c)

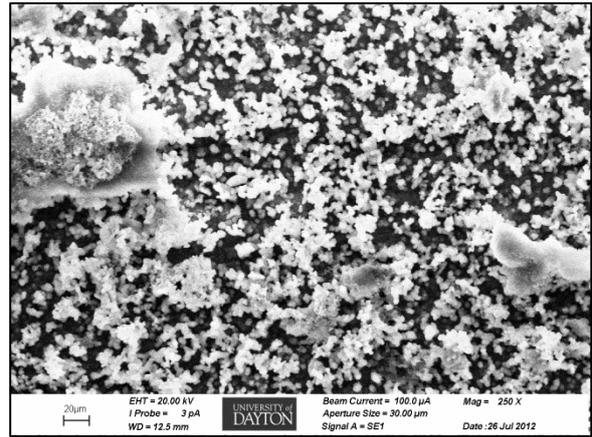


(d)

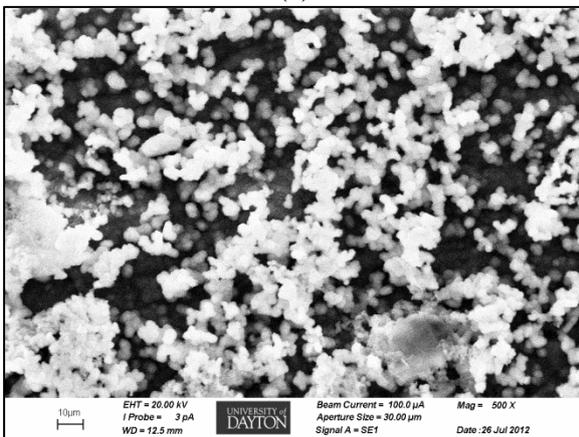
Figure O-29. SEM images of aluminum alloy 6061 sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



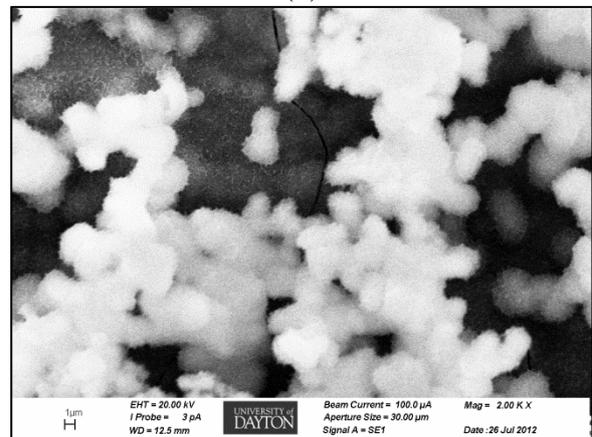
(a)



(b)

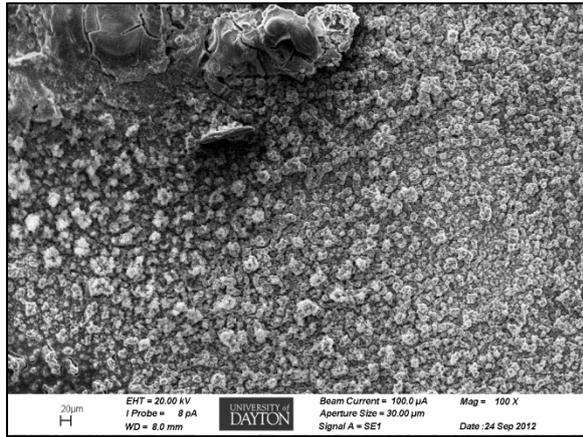


(c)

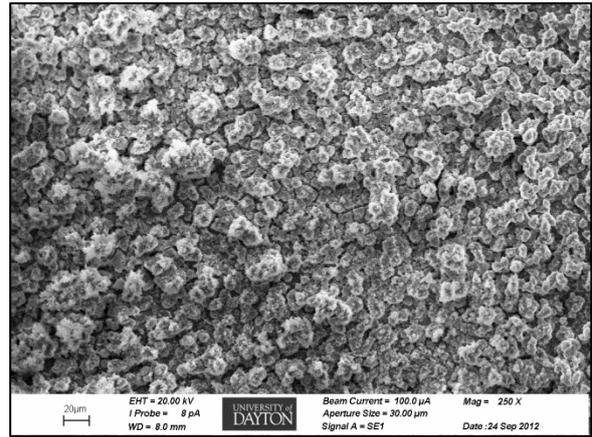


(d)

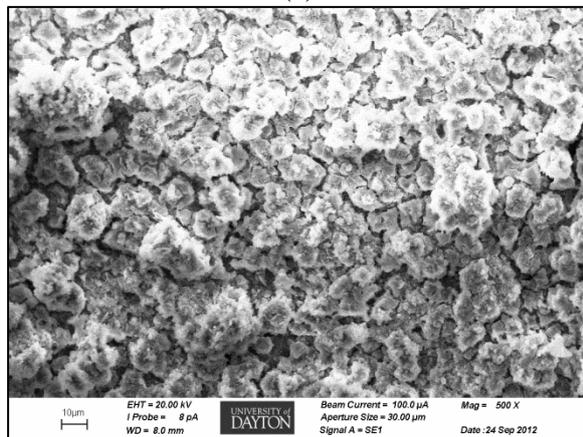
Figure O-30. SEM images of aluminum alloy 6061 sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



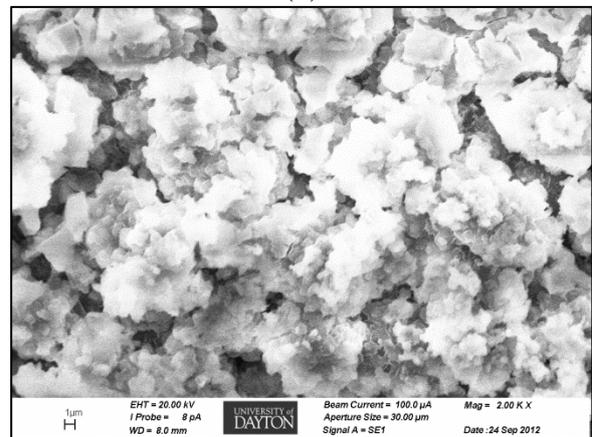
(a)



(b)

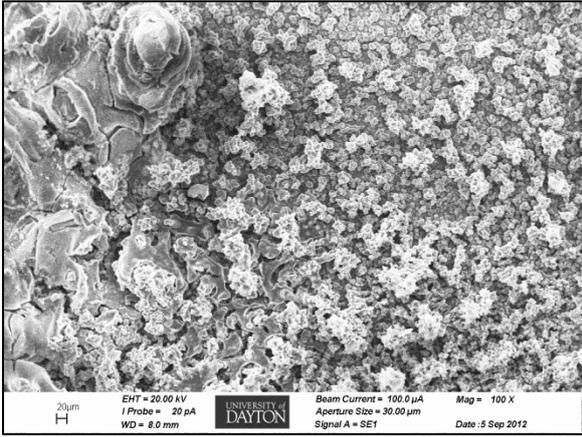


(c)

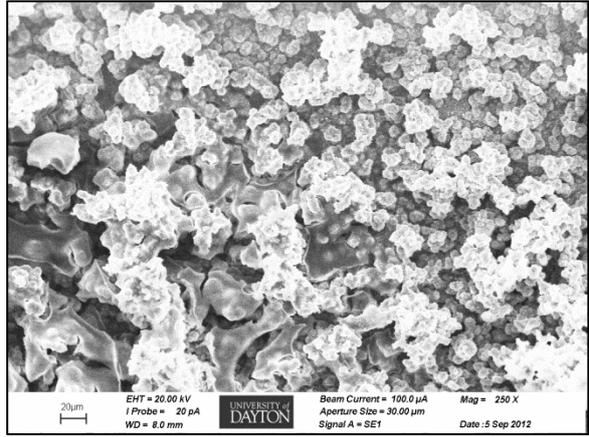


(d)

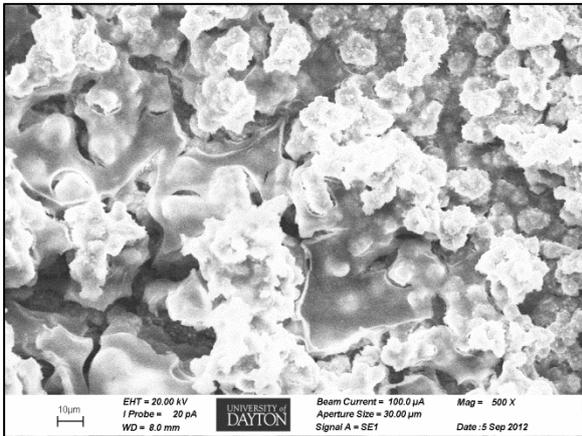
Figure O-31. SEM images of aluminum alloy 2024 sample retrieved on 1000 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



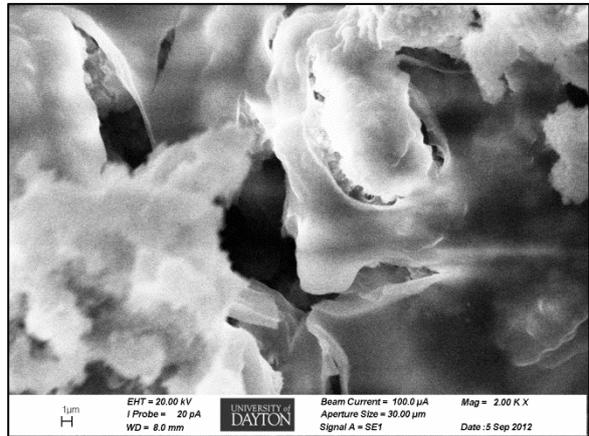
(a)



(b)

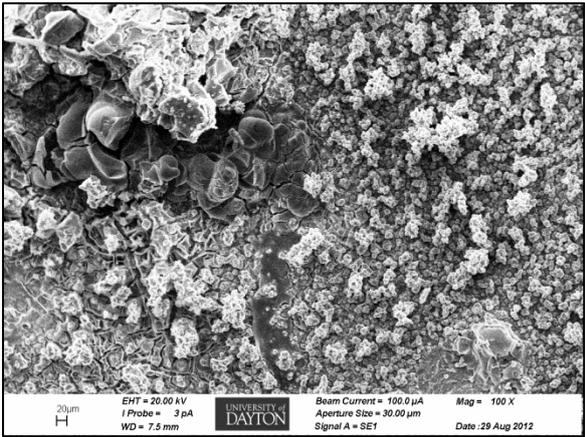


(c)

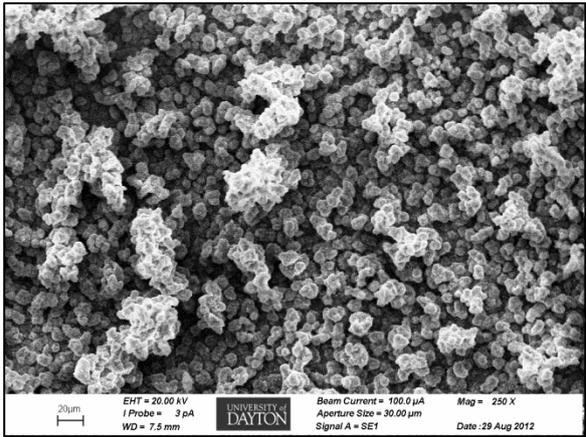


(d)

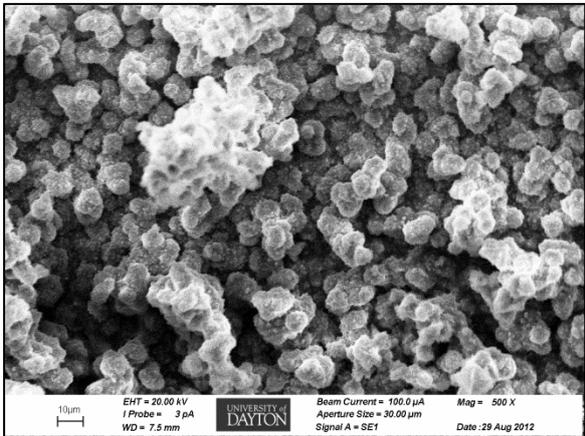
Figure O-32. SEM images of aluminum alloy 2024 sample retrieved on 900 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



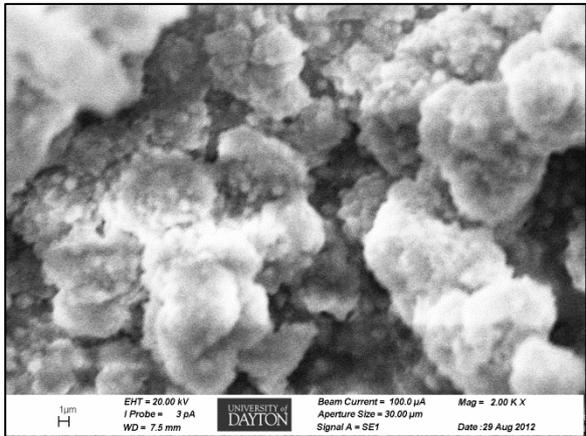
(a)



(b)

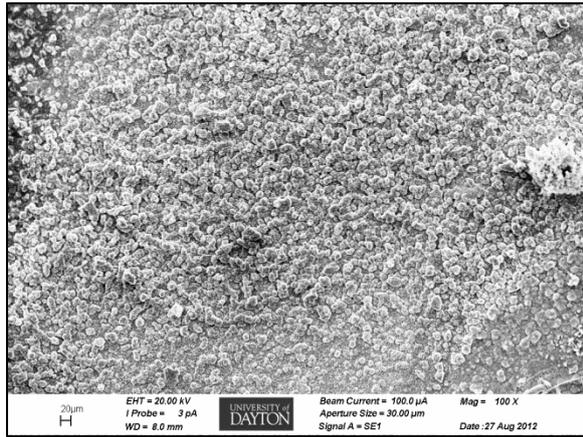


(c)

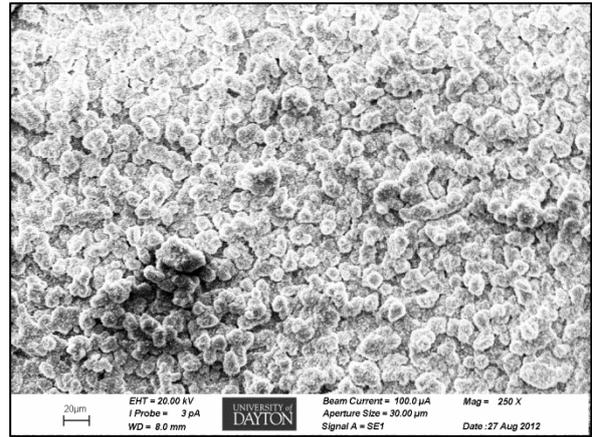


(d)

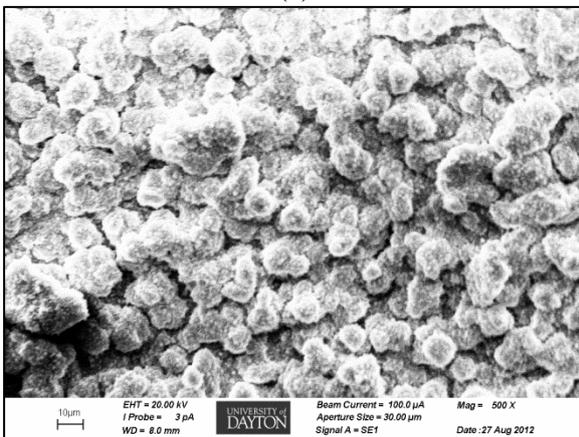
Figure O-33. SEM images of aluminum alloy 2024 sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



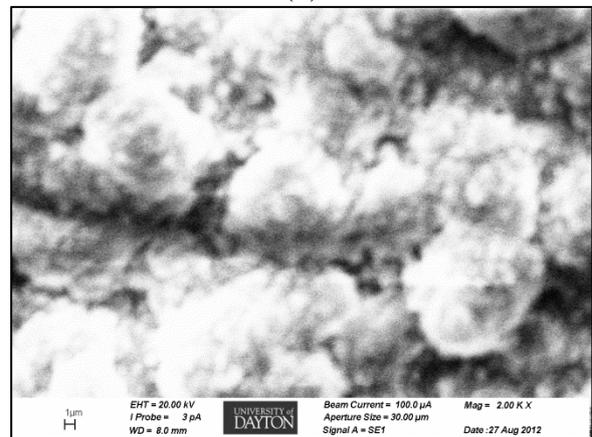
(a)



(b)

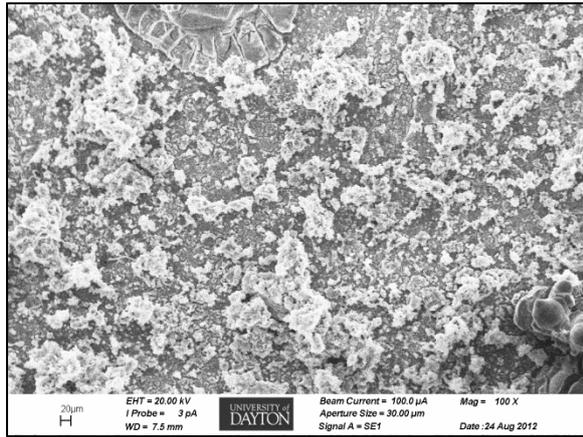


(c)

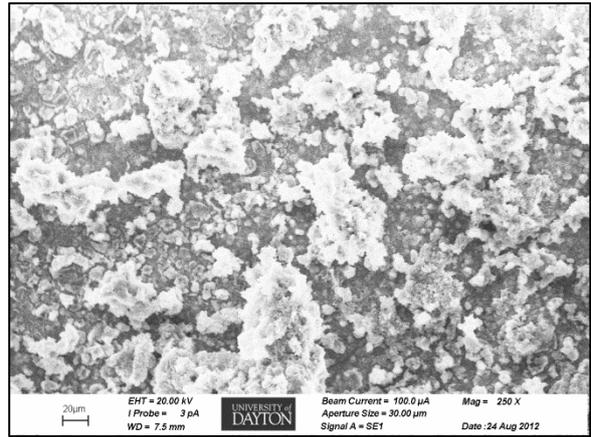


(d)

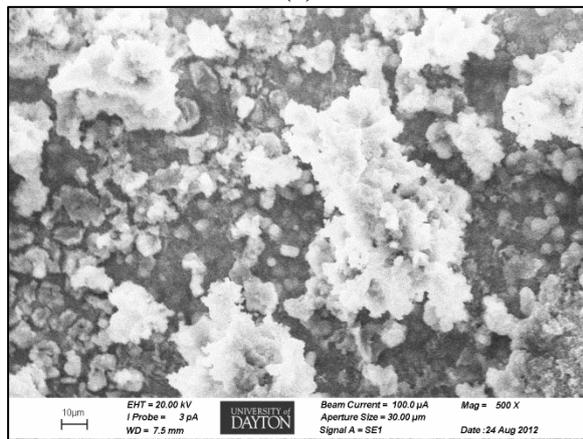
Figure O-34. SEM images of aluminum alloy 2024 sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



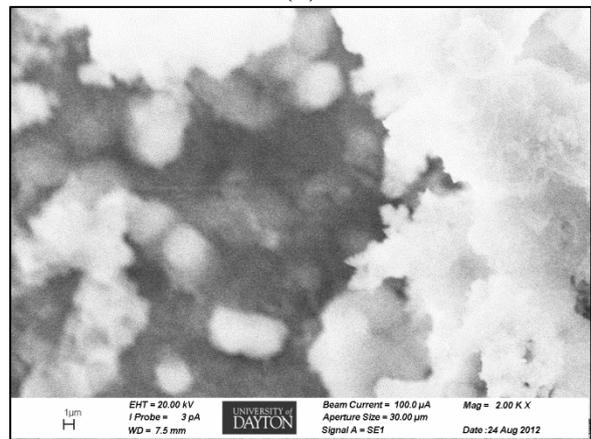
(a)



(b)

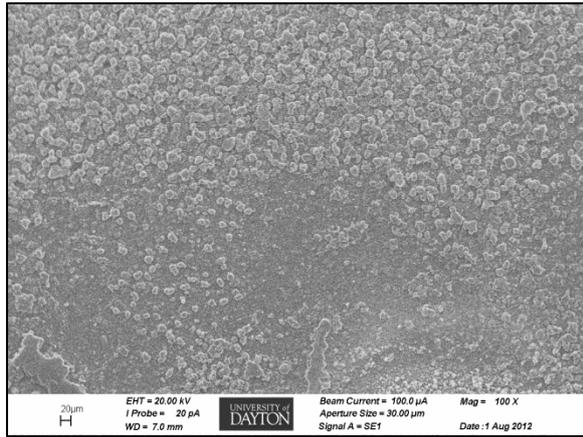


(c)

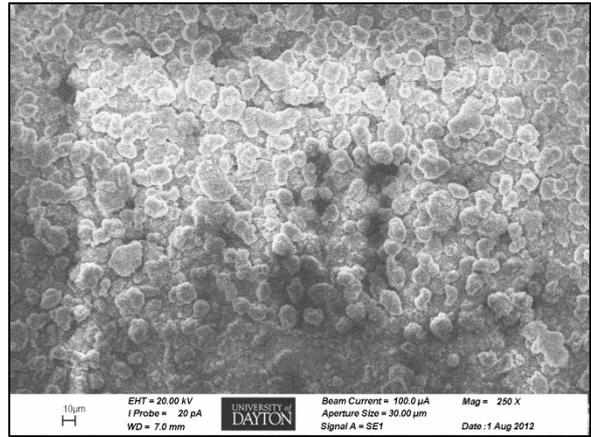


(d)

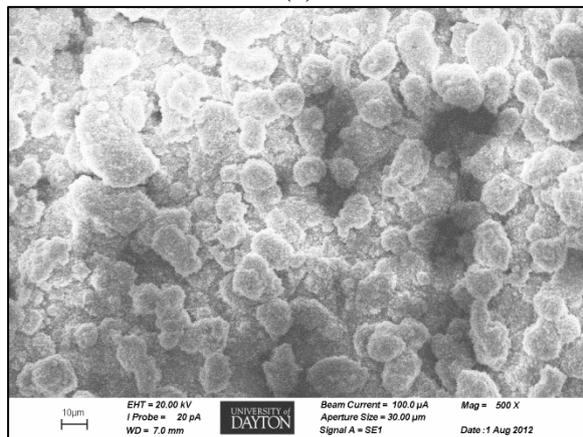
Figure O-35. SEM images of aluminum alloy 2024 sample retrieved on 600 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



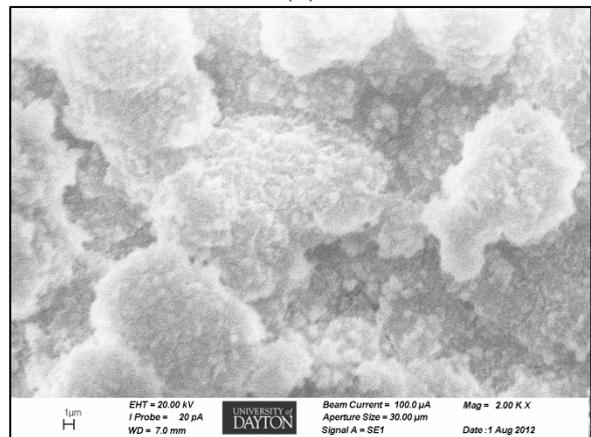
(a)



(b)

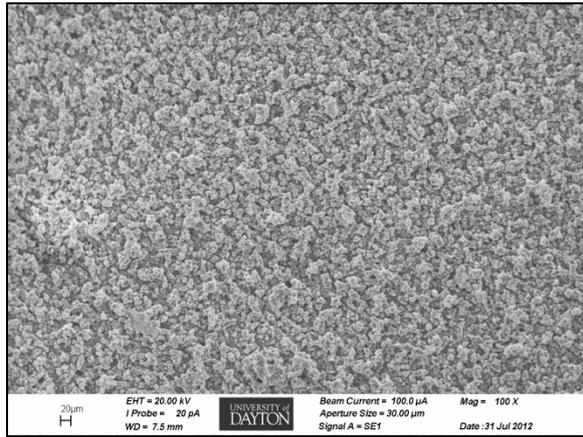


(c)

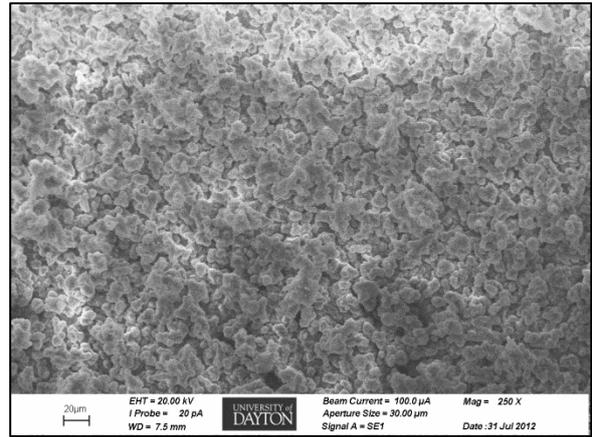


(d)

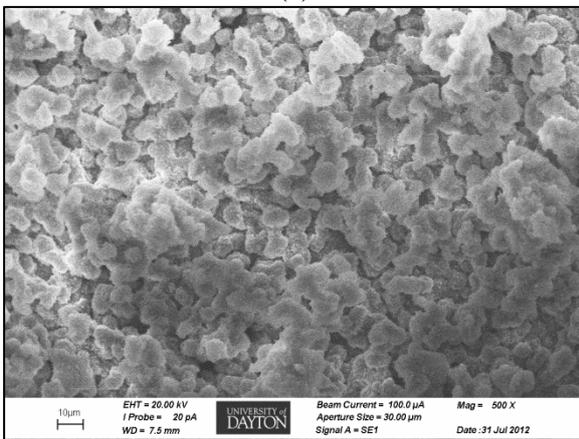
Figure O-36. SEM images of aluminum alloy 2024 sample retrieved on 500 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



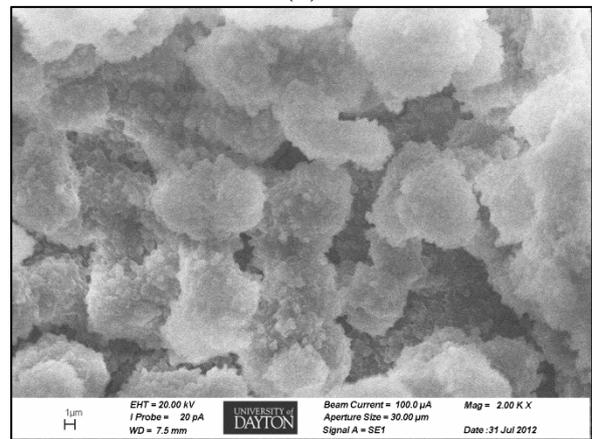
(a)



(b)

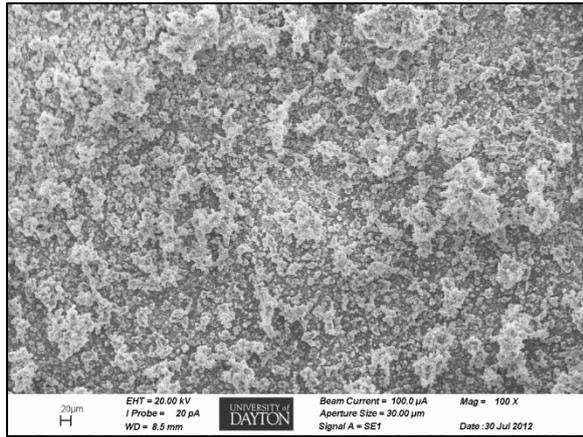


(c)

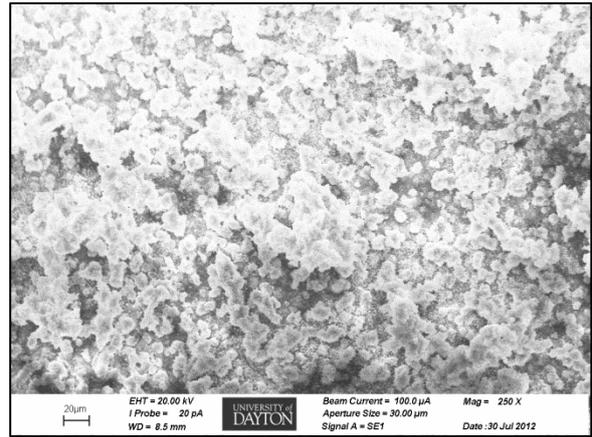


(d)

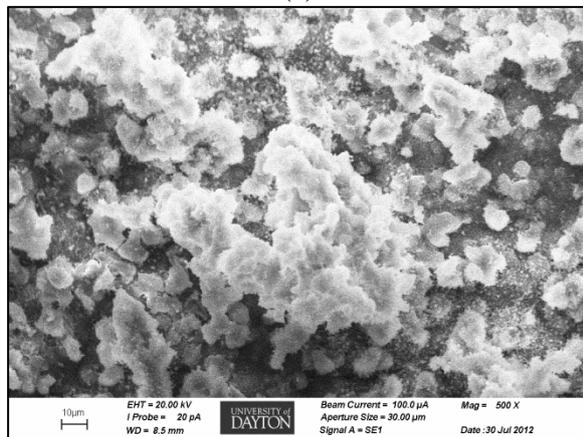
Figure O-37. SEM images of aluminum alloy 2024 sample retrieved on 400 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification., and (d) 2000X magnification.



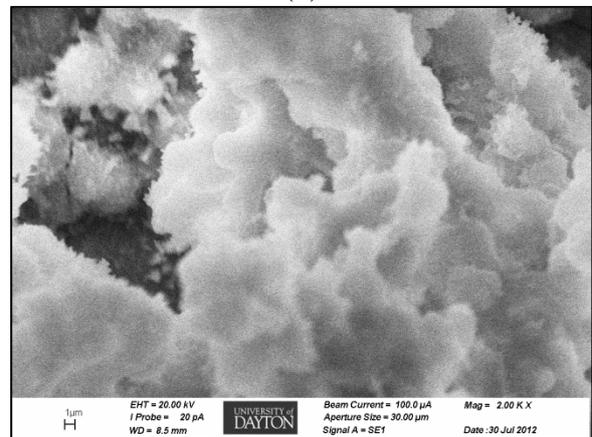
(a)



(b)

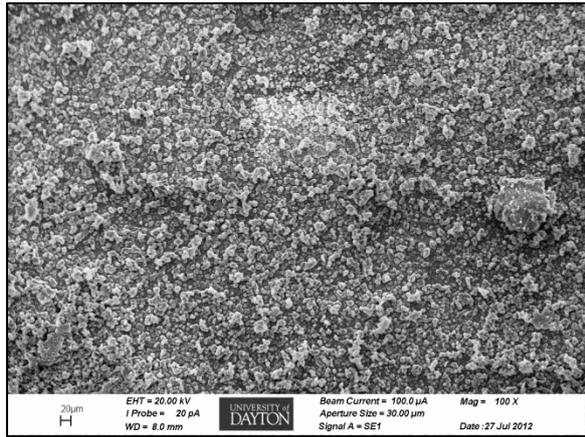


(c)

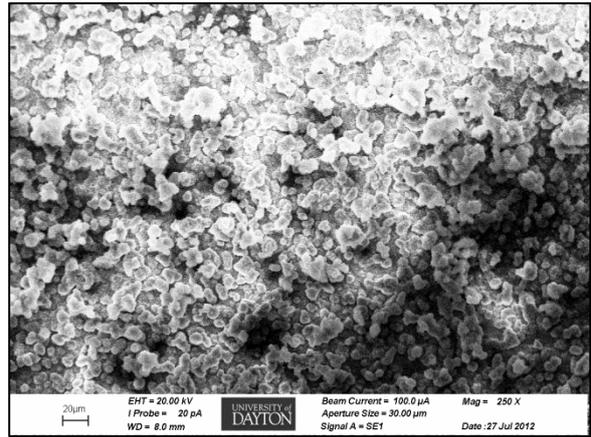


(d)

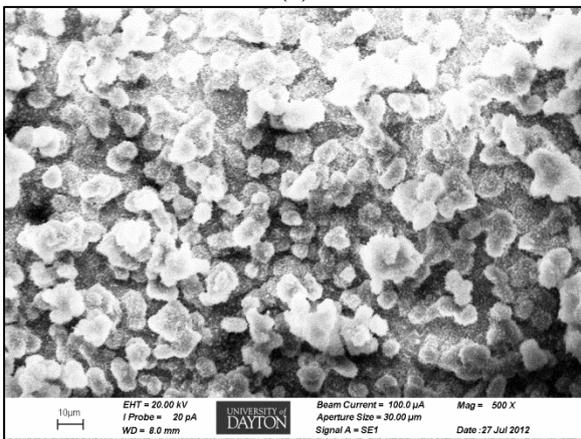
Figure O-38. SEM images of aluminum alloy 2024 sample retrieved on 300 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



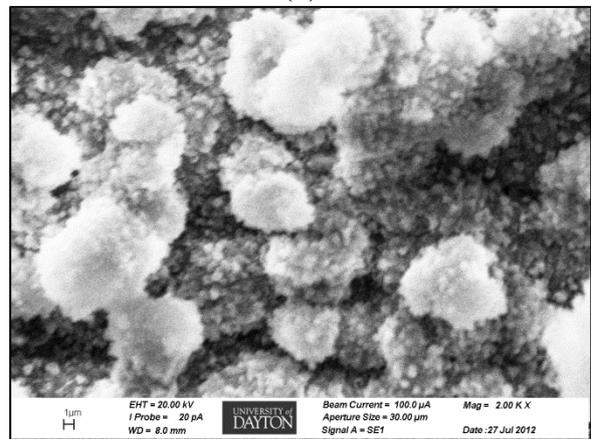
(a)



(b)

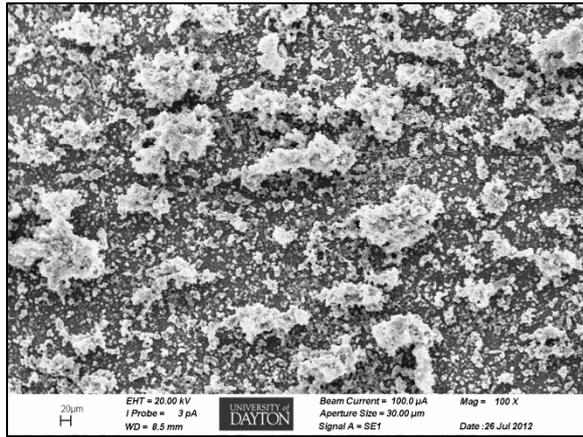


(c)

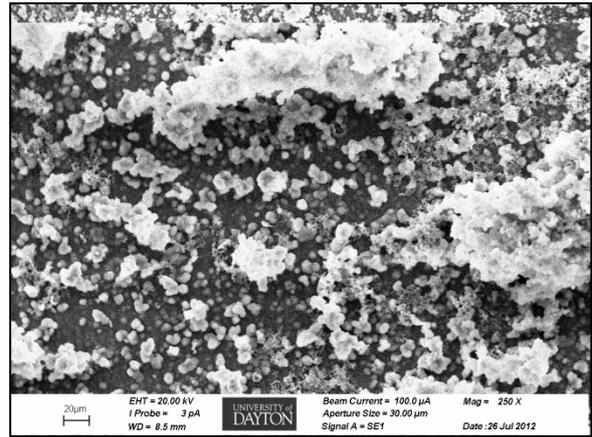


(d)

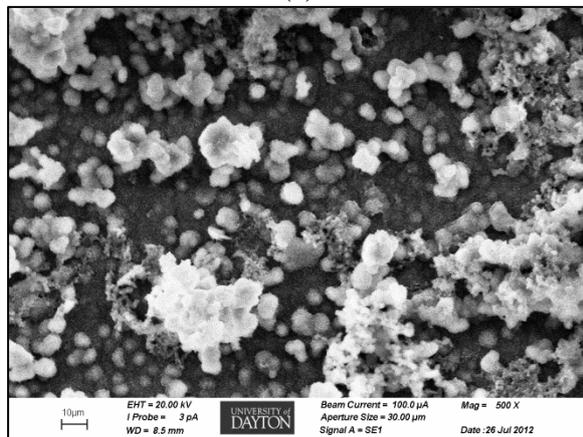
Figure O-39. SEM images of aluminum alloy 2024 sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification., and (d) 2000X magnification.



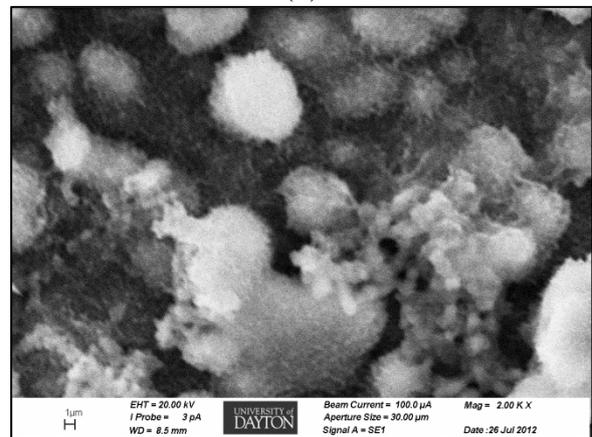
(a)



(b)

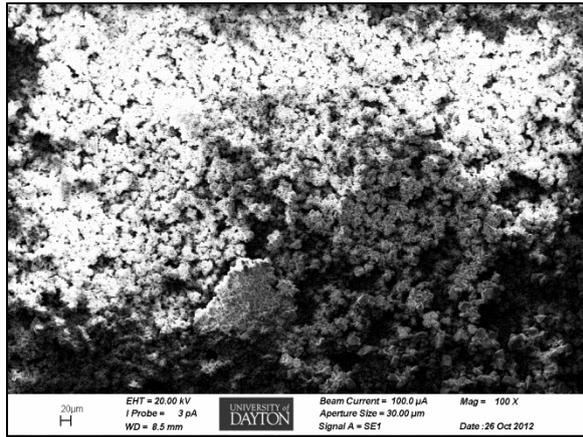


(c)

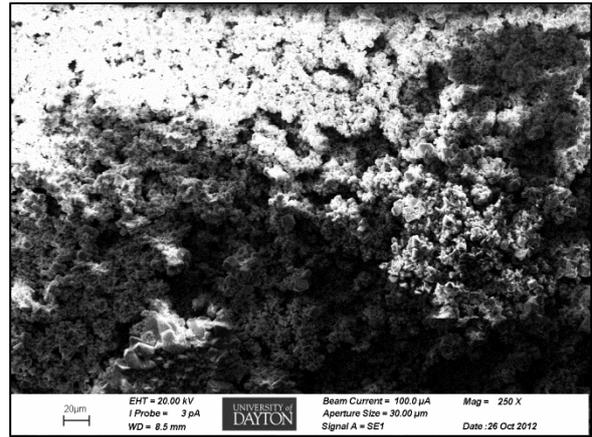


(d)

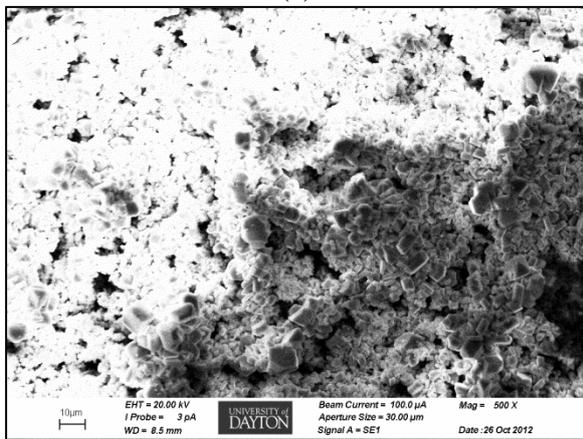
Figure O-40. SEM images of aluminum alloy 2024 sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



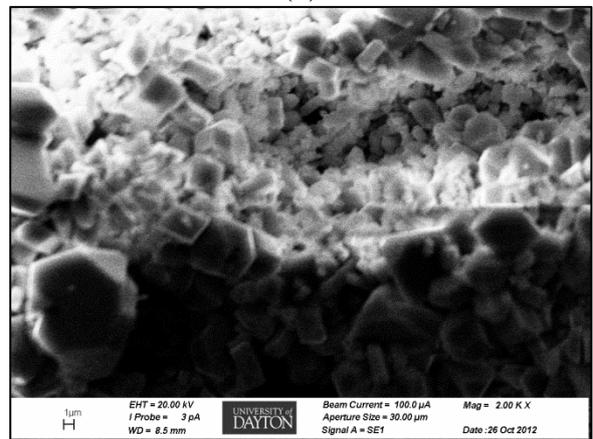
(a)



(b)

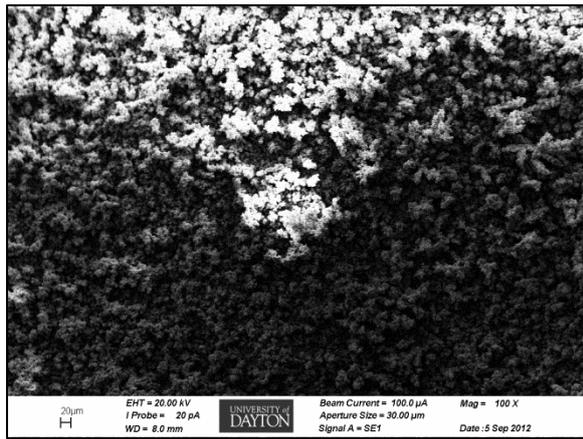


(c)

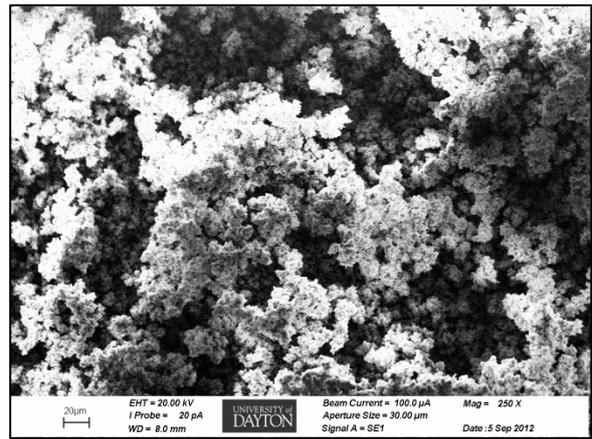


(d)

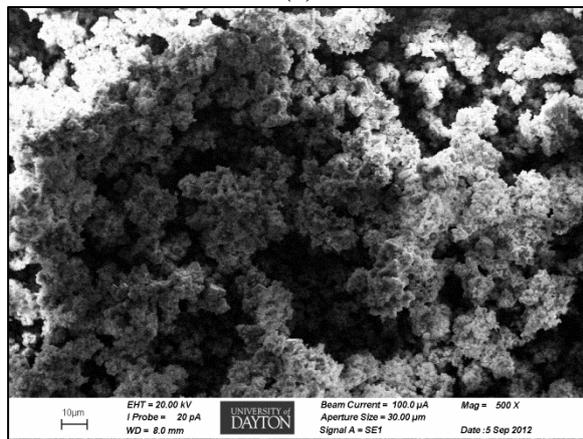
Figure O-41. SEM images of pure copper sample retrieved on 1000 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



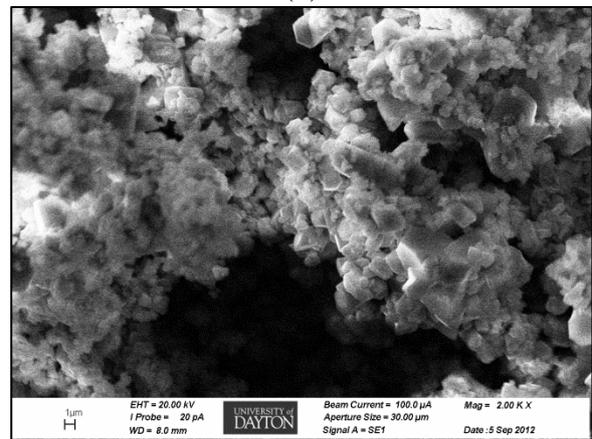
(a)



(b)

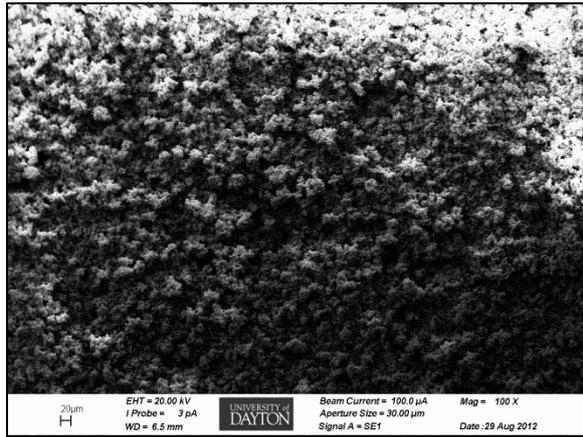


(c)

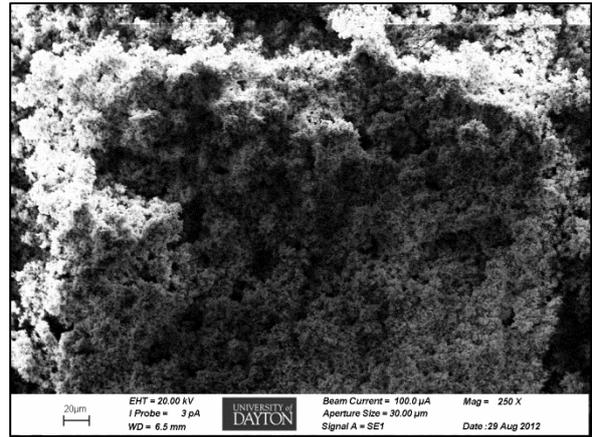


(d)

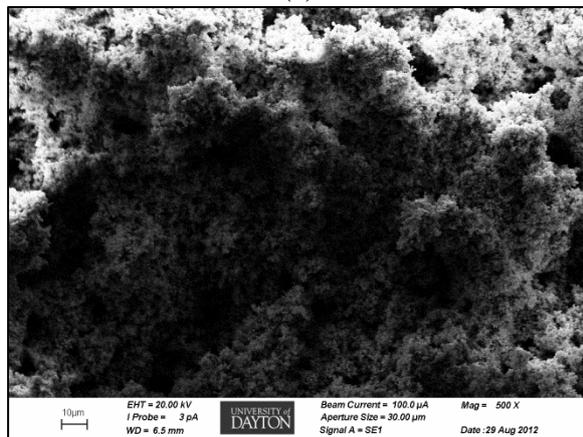
Figure O-42. SEM images of pure copper sample retrieved on 900 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



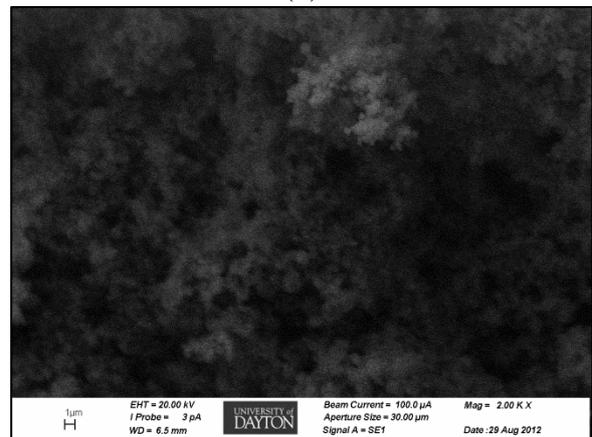
(a)



(b)

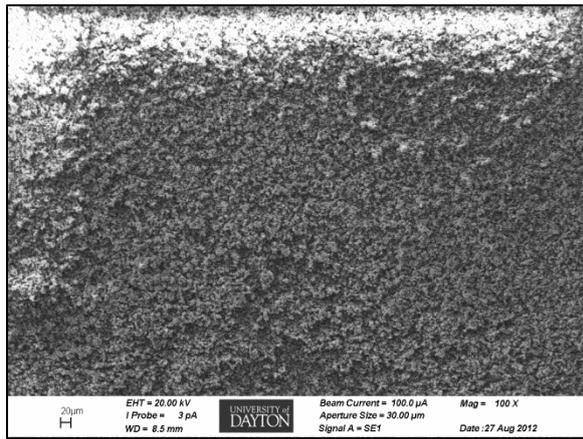


(c)

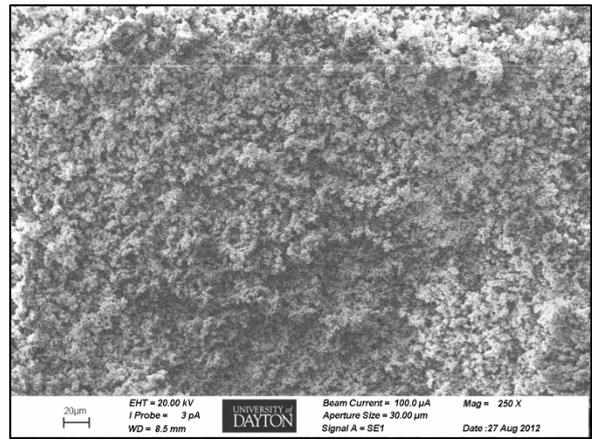


(d)

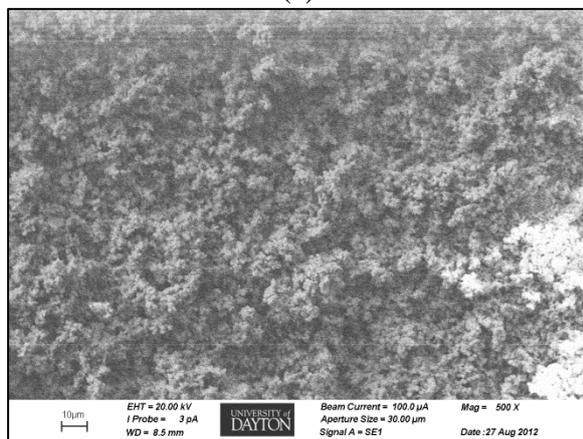
Figure O-43. SEM images of pure copper sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



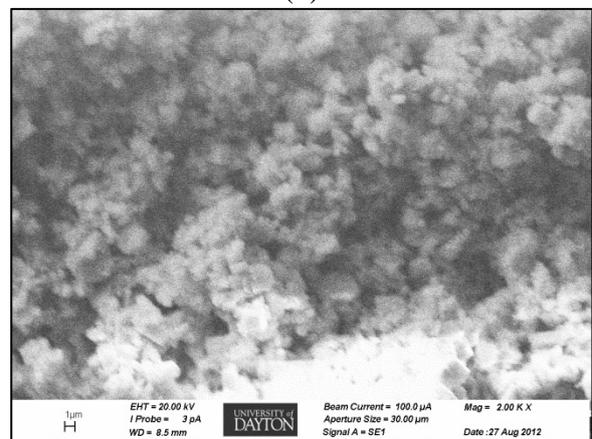
(a)



(b)

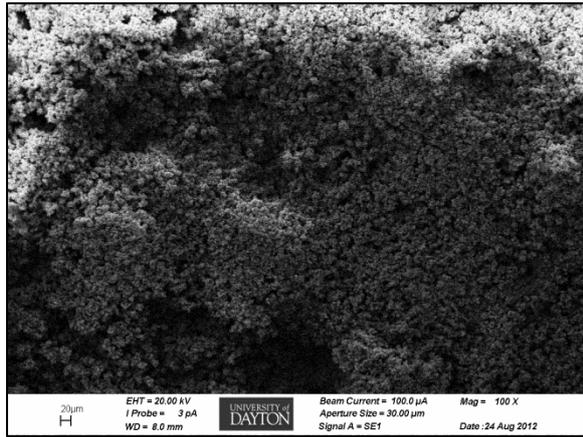


(c)

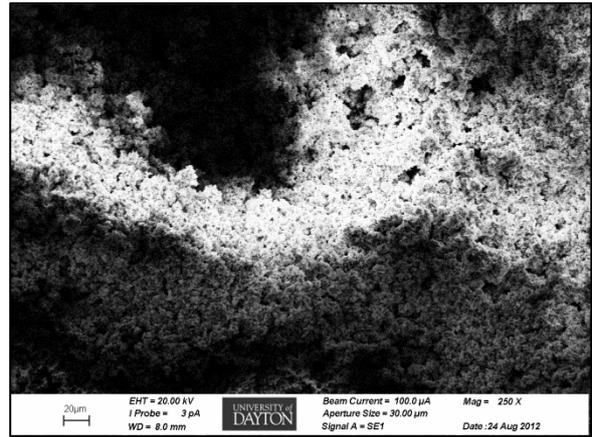


(d)

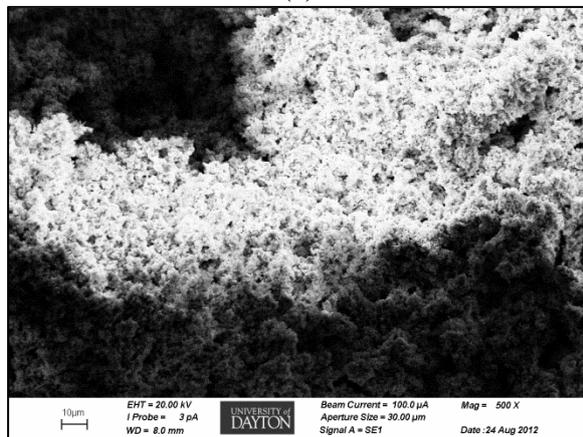
Figure O-44. SEM images of pure copper sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



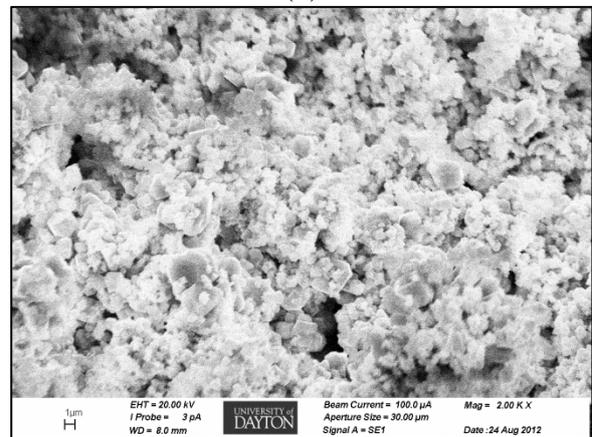
(a)



(b)

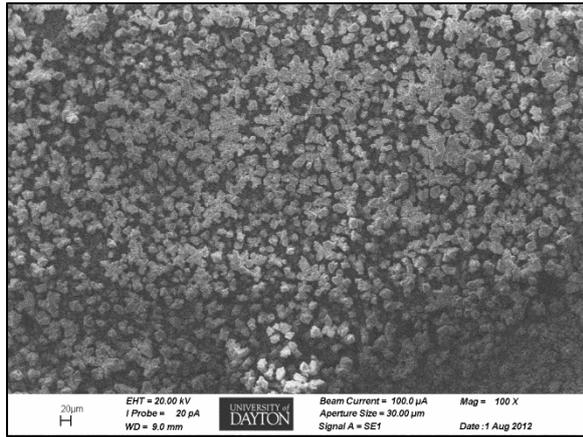


(c)

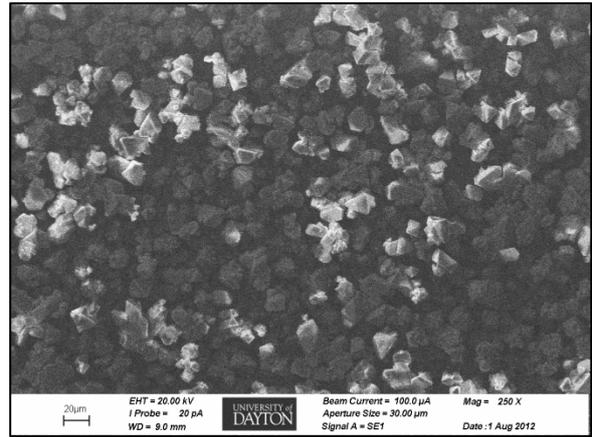


(d)

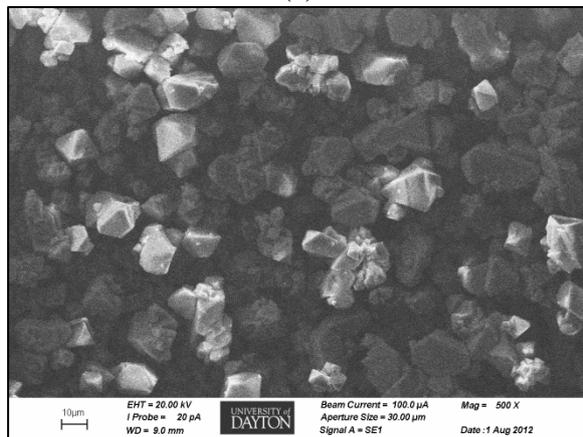
Figure O-45. SEM images of pure copper sample retrieved on 600 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



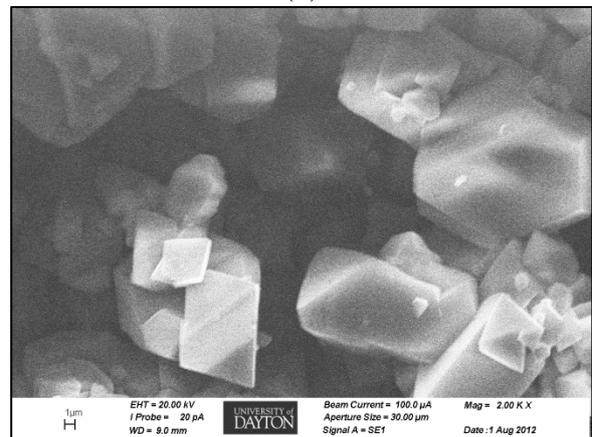
(a)



(b)

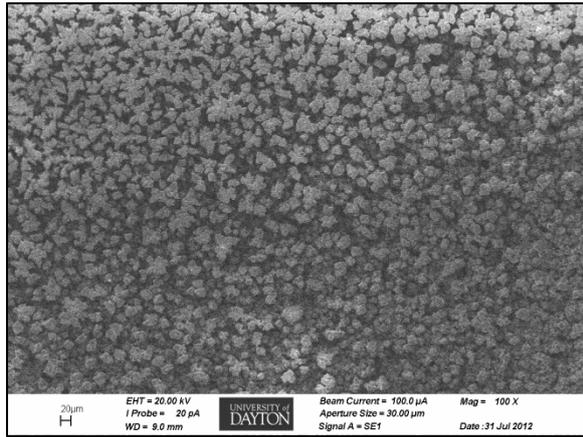


(c)

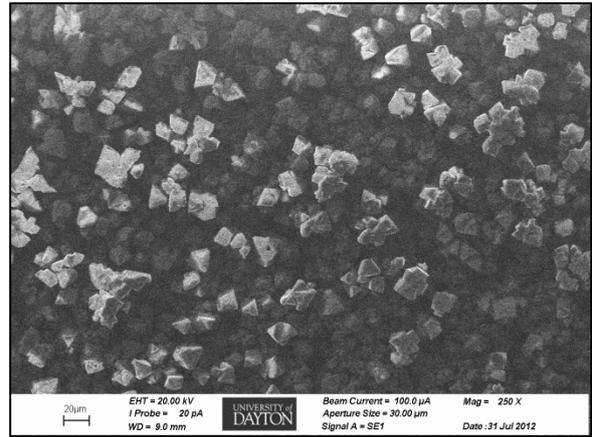


(d)

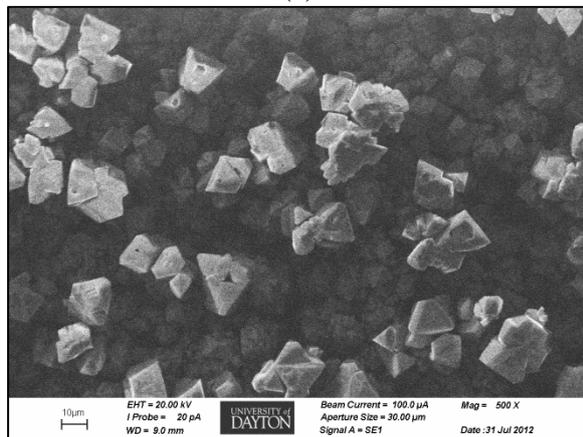
Figure O-46. SEM images of pure copper sample retrieved on 500 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



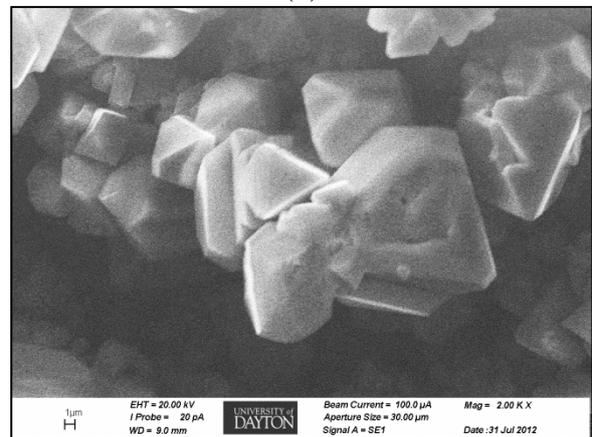
(a)



(b)

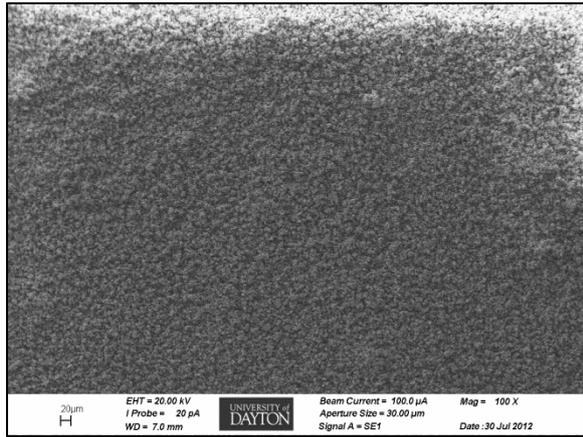


(c)

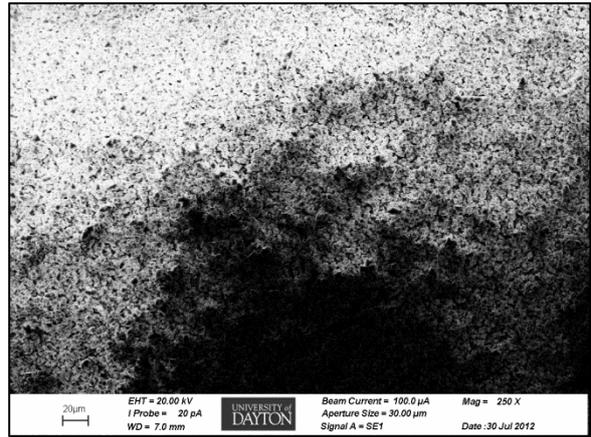


(d)

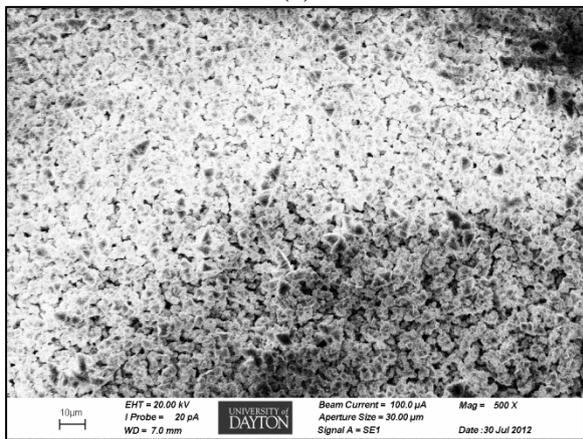
Figure O-47. SEM images of pure copper sample retrieved on 400 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



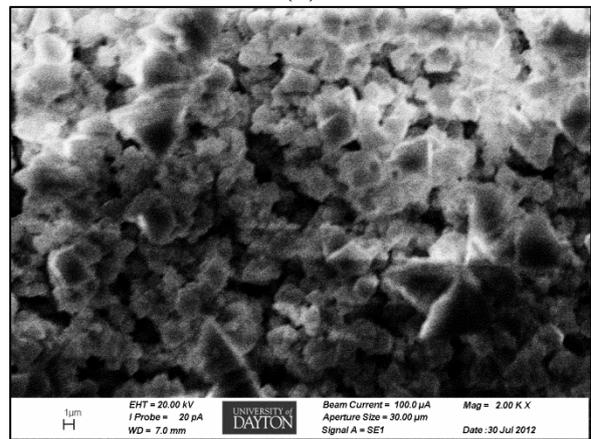
(a)



(b)

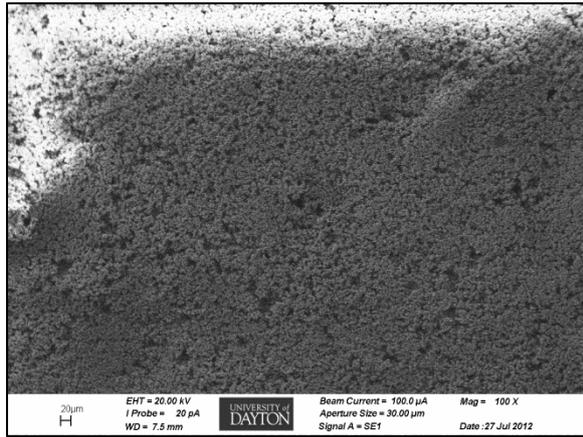


(c)

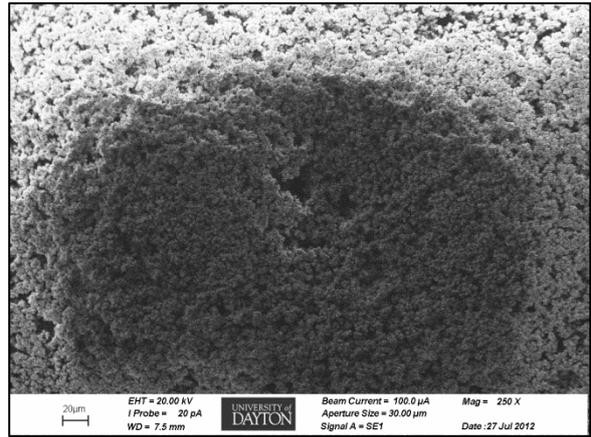


(d)

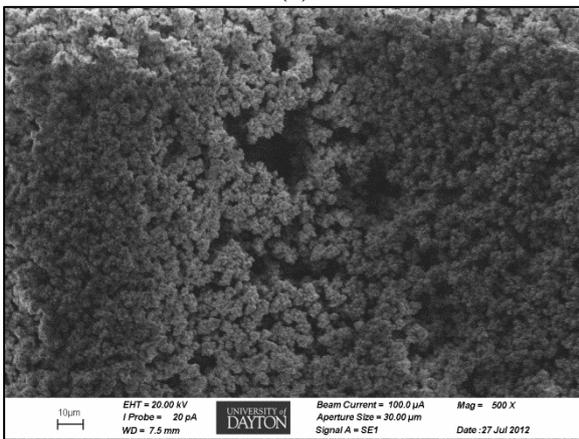
Figure O-48. SEM images of pure copper sample retrieved on 300 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification, (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



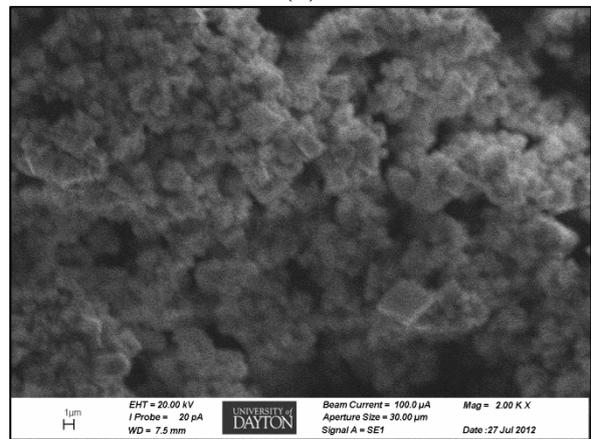
(a)



(b)

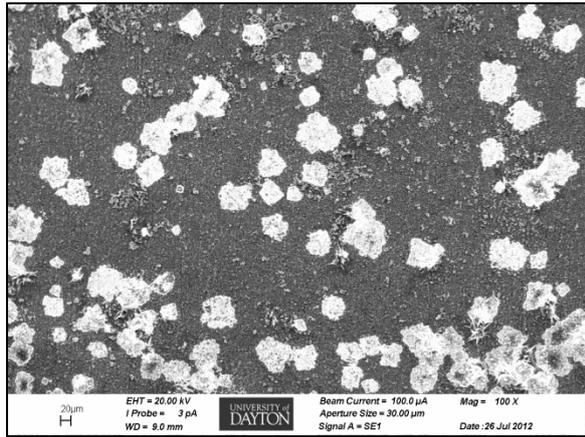


(c)

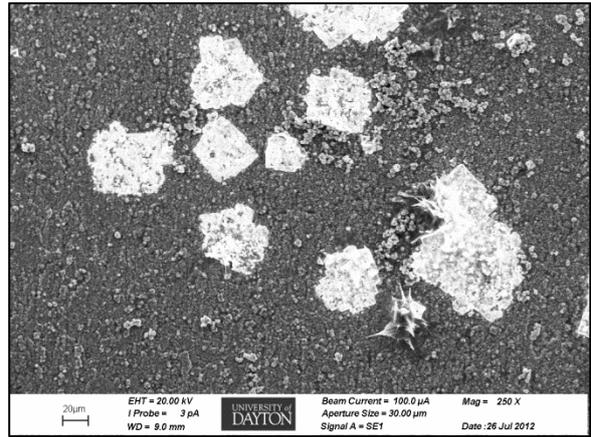


(d)

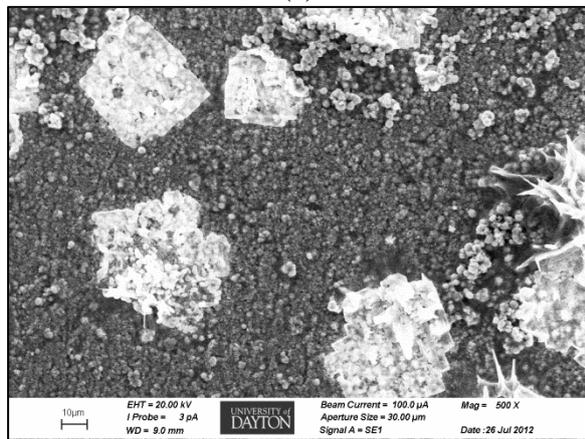
Figure O-49. SEM images of pure copper sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



(a)



(b)



(c)

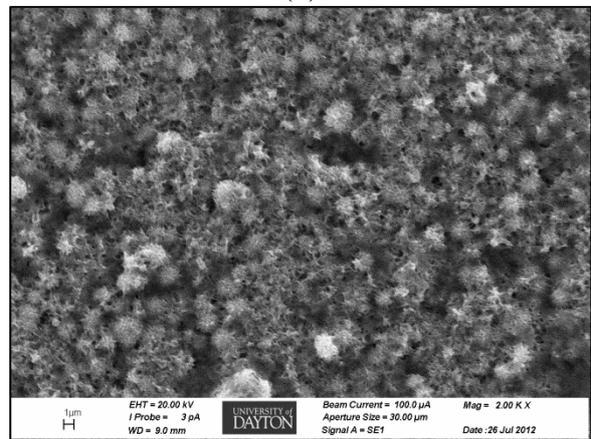
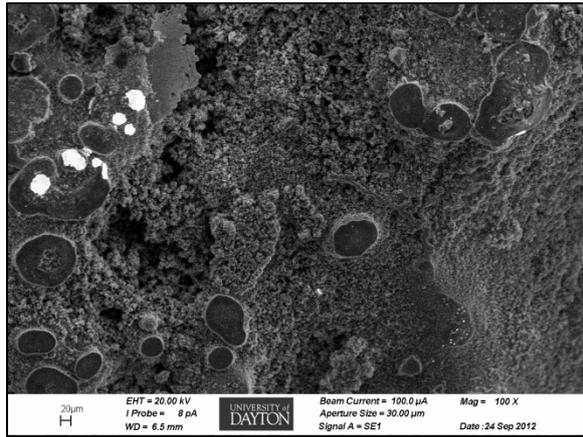
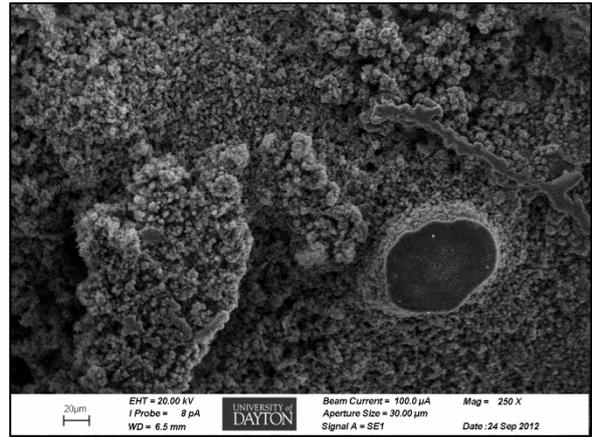


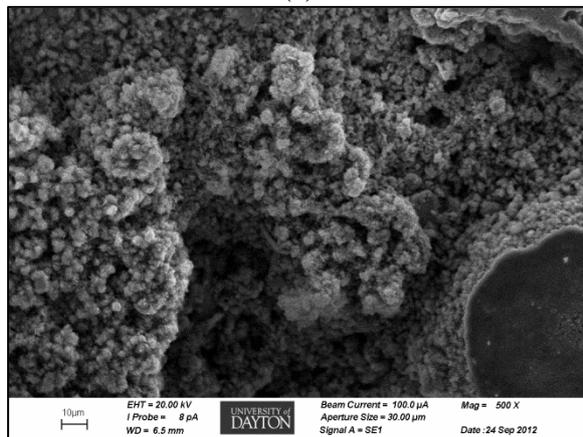
Figure O-50. SEM images of pure copper sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification, (b) 250X magnification, and (c) 500X magnification.



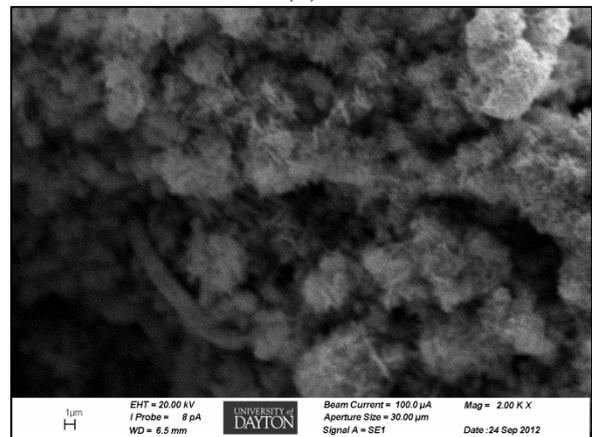
(a)



(b)

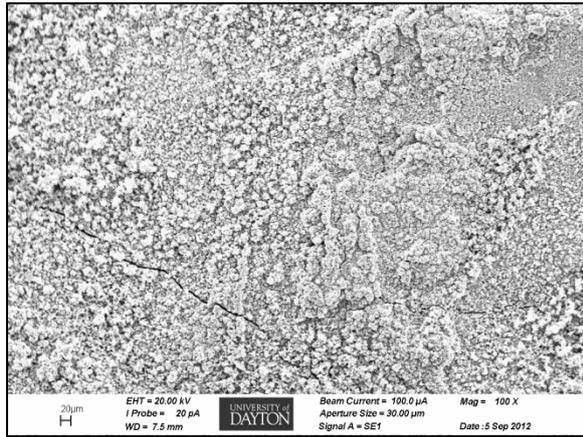


(c)

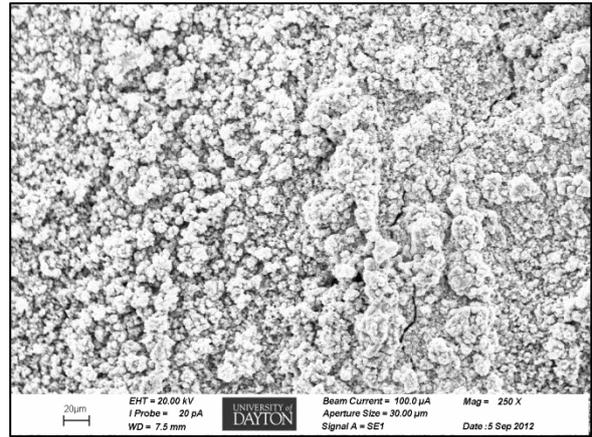


(d)

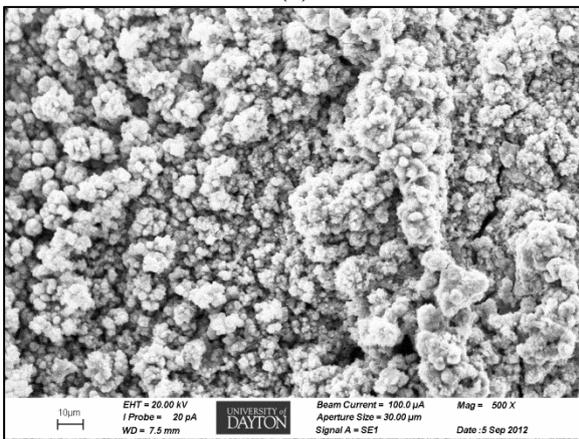
Figure O-51. SEM images of 1010 steel sample retrieved on 1000 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 500X magnification.



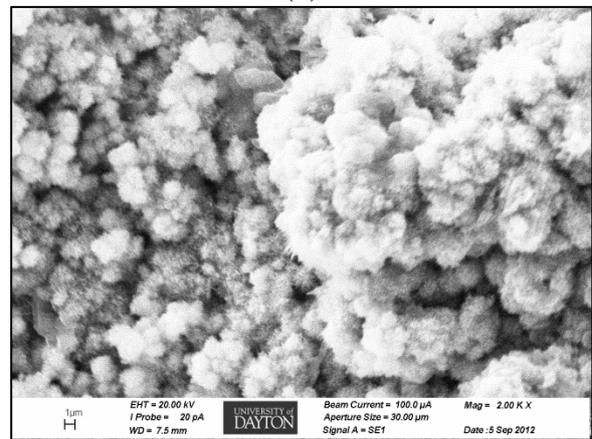
(a)



(b)

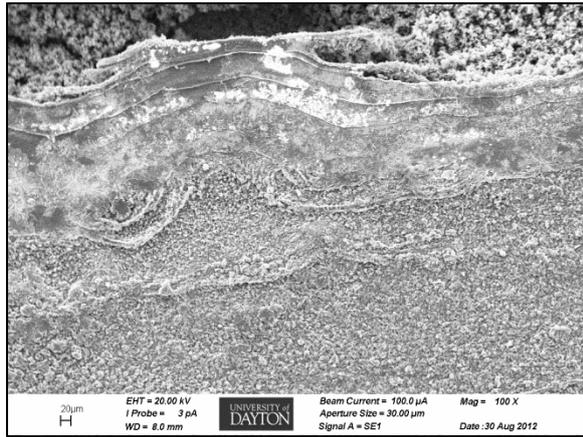


(c)

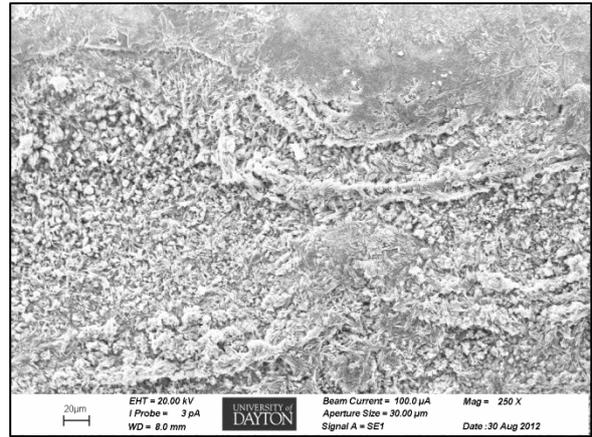


(d)

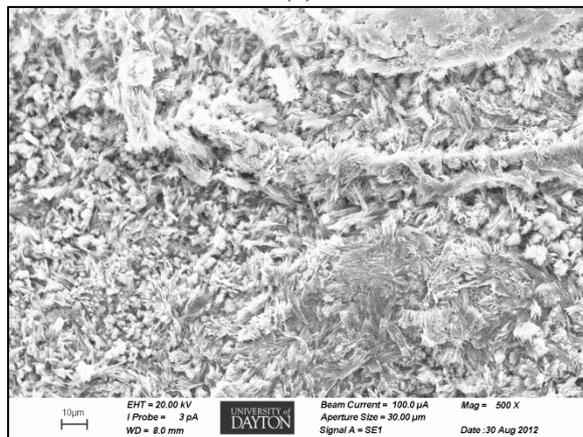
Figure O-52. SEM images of 1010 steel sample retrieved on 900 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



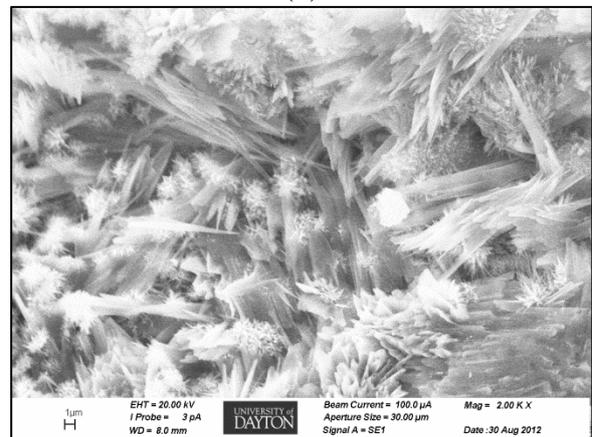
(a)



(b)

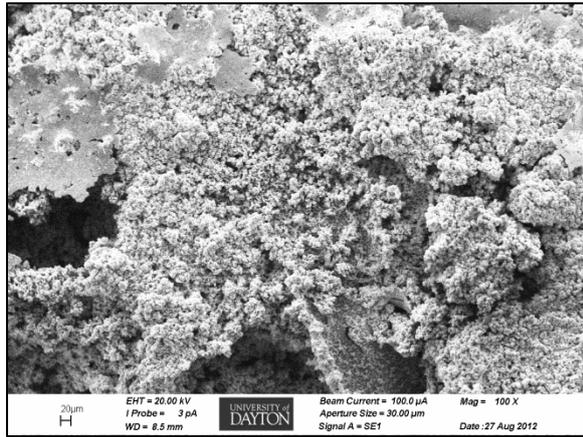


(c)

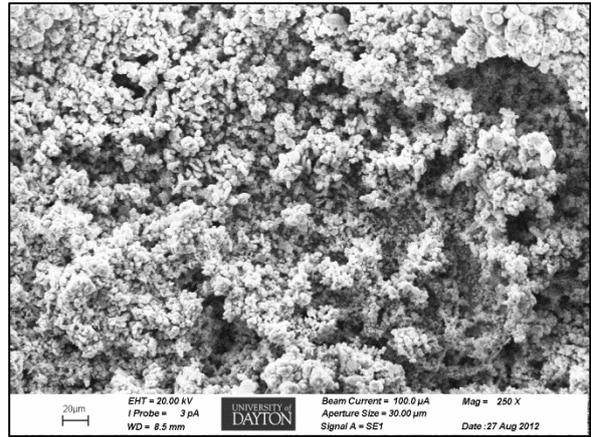


(d)

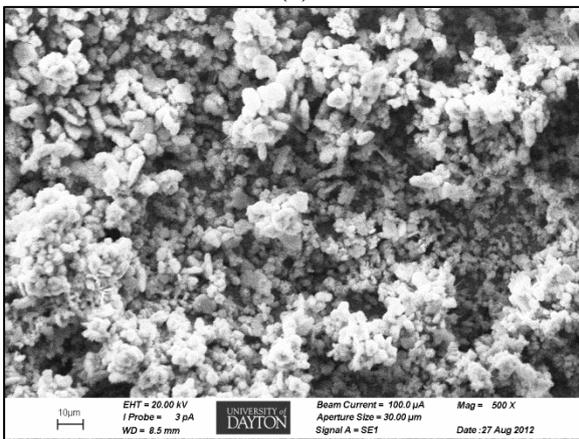
Figure O-53. SEM images of 1010 steel sample retrieved on 800 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



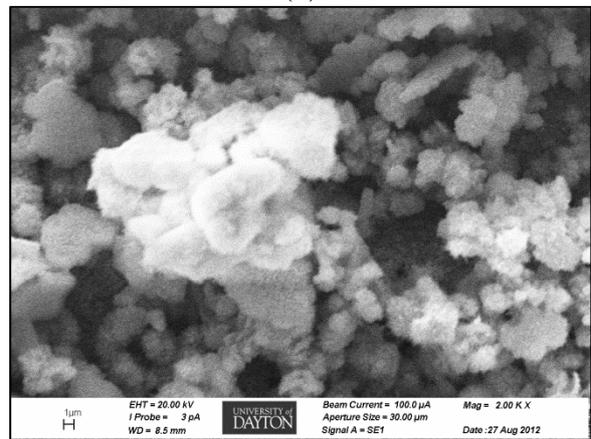
(a)



(b)

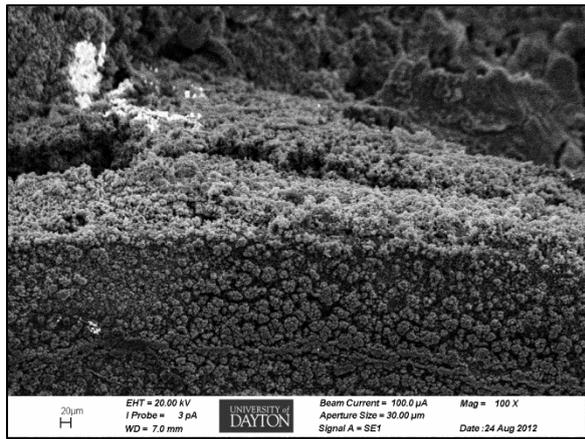


(c)

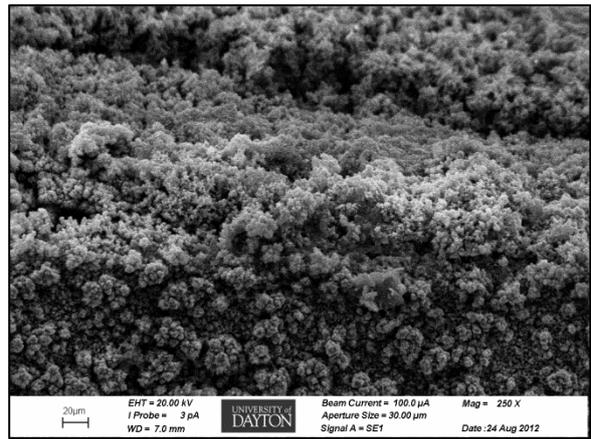


(d)

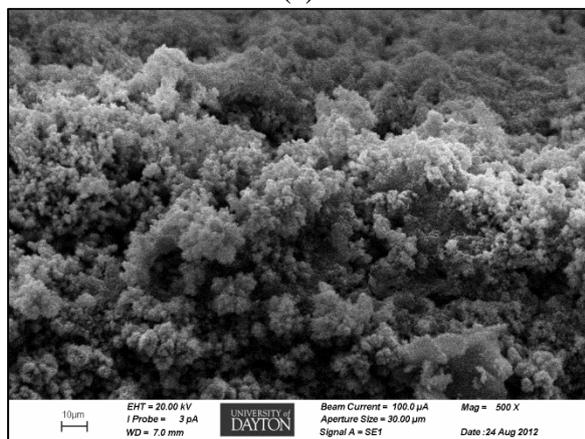
Figure O-54. SEM images of 1010 steel sample retrieved on 700 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



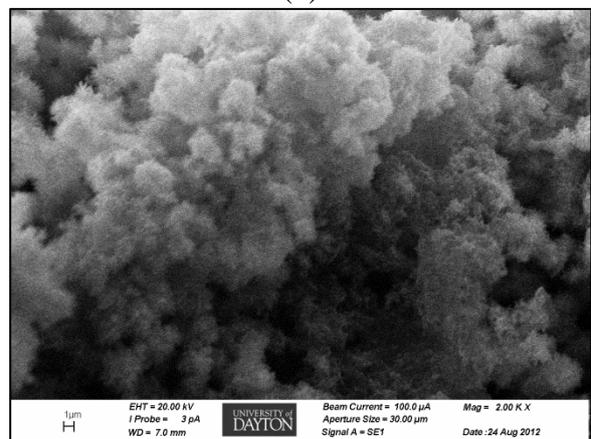
(a)



(b)

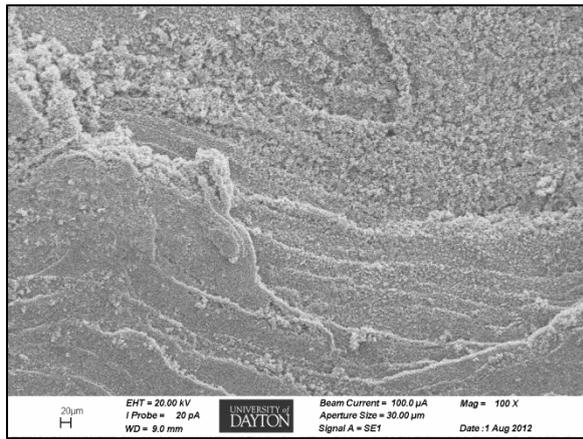


(c)

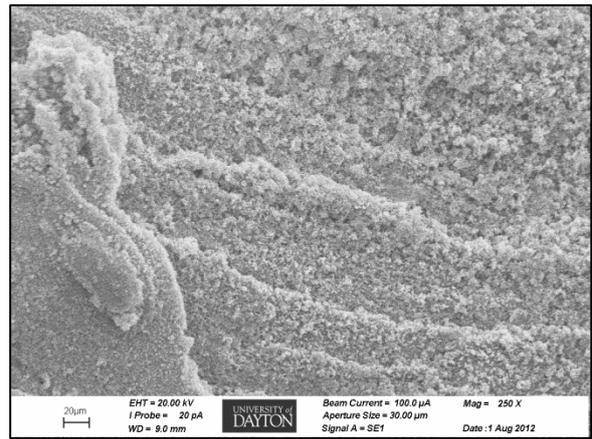


(d)

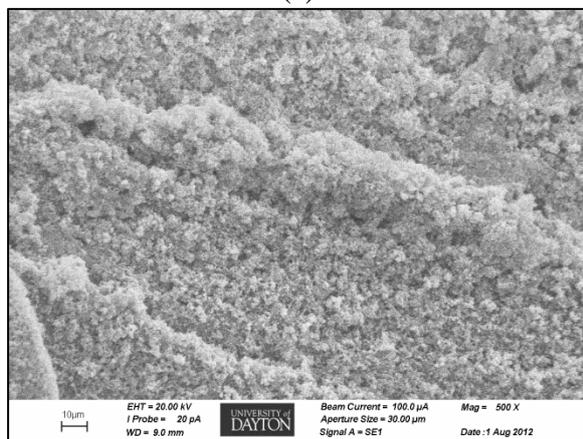
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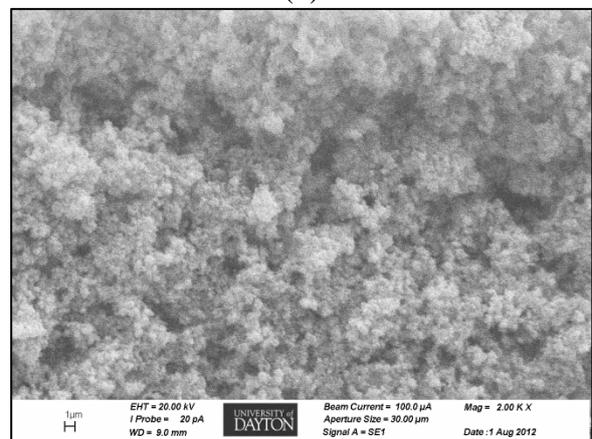
(a)



(b)

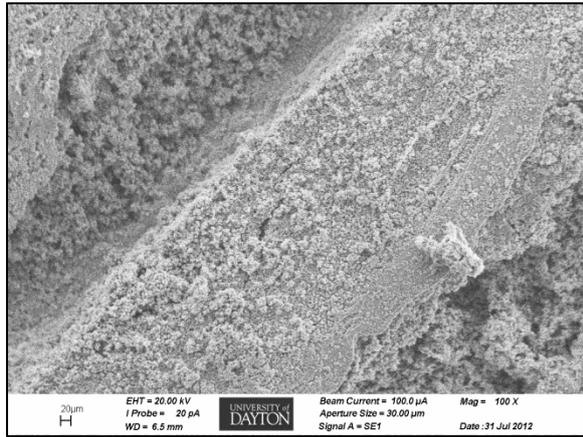


(c)

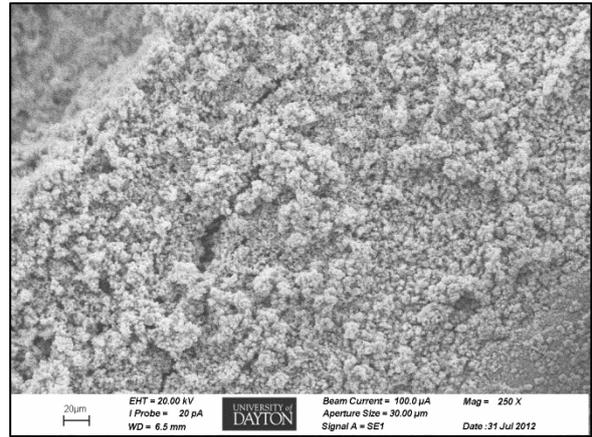


(d)

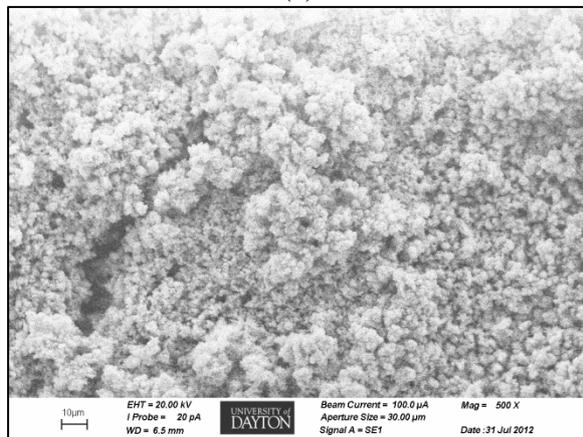
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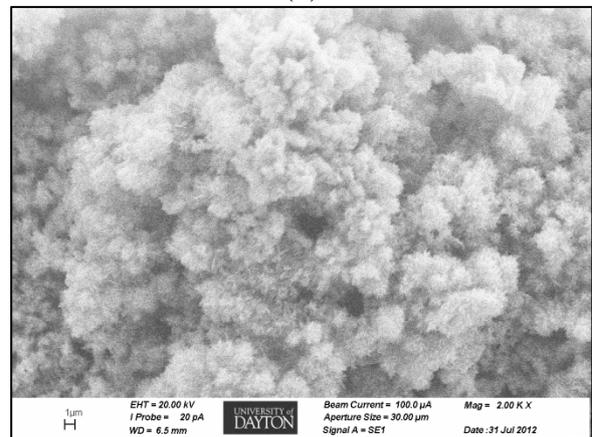
(a)



(b)

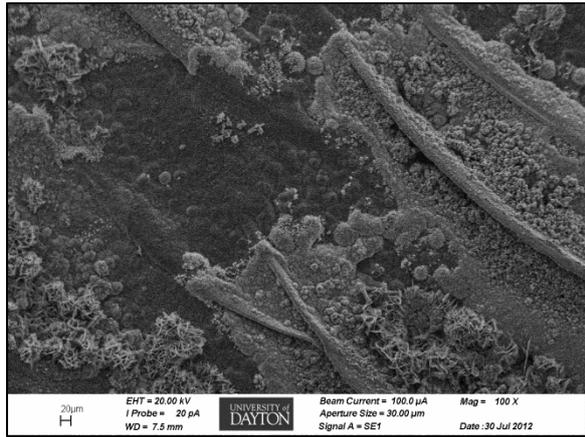


(c)

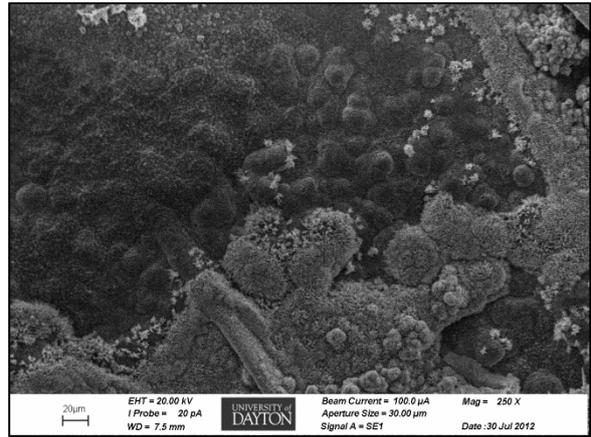


(d)

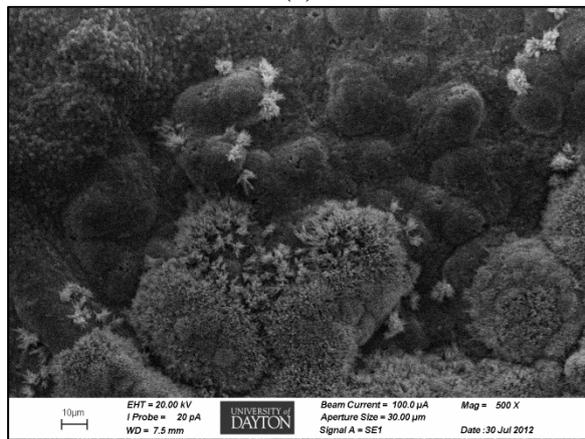
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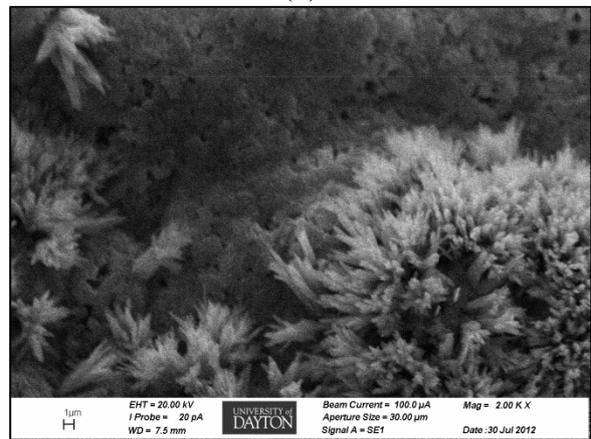
(a)



(b)

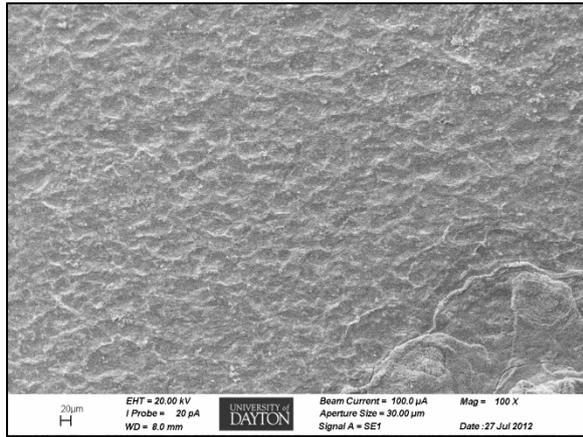


(c)

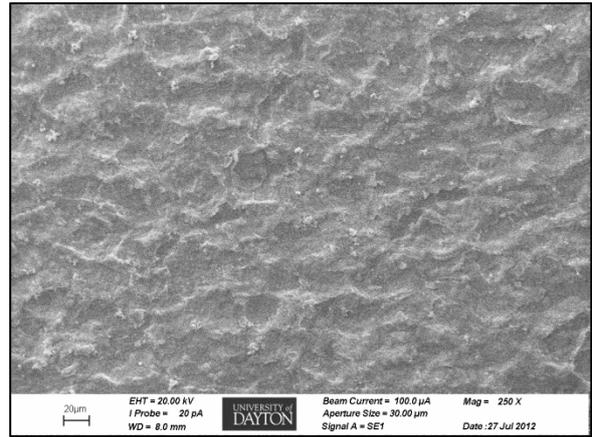


(d)

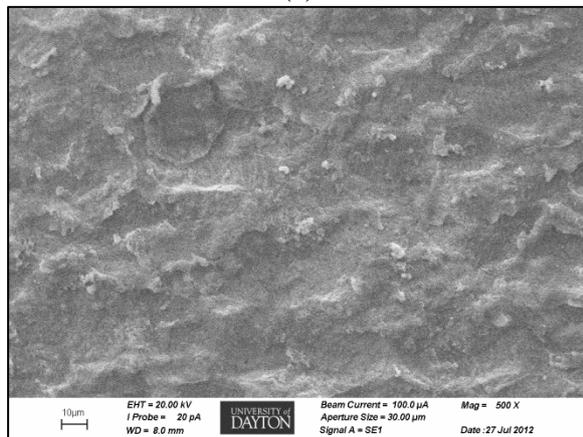
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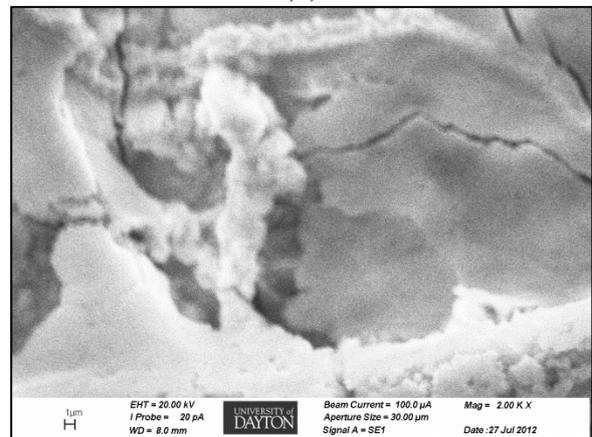
(a)



(b)

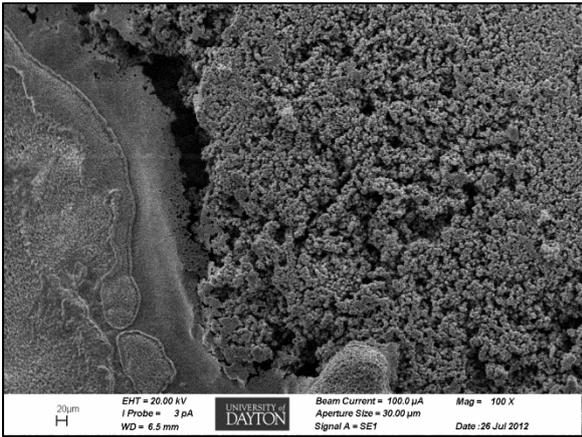


(c)

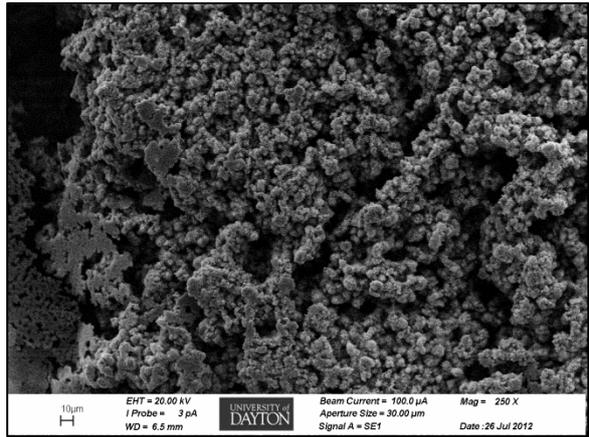


(d)

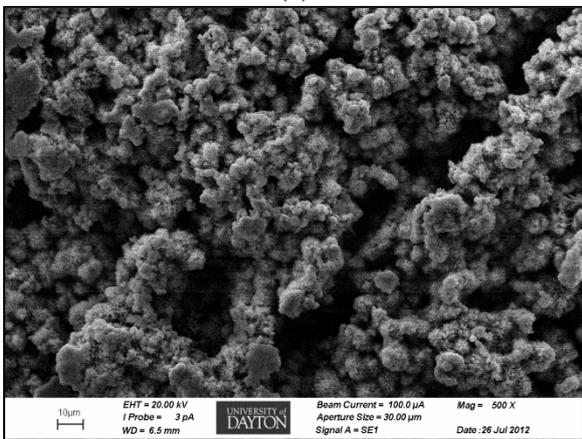
Figure O-59. SEM images of 1010 steel sample retrieved on 200 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



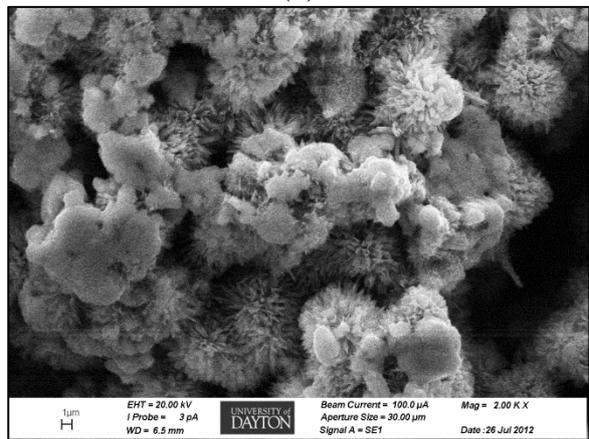
(a)



(b)



(c)



(d)

Figure O-60. SEM images of 1010 steel sample retrieved on 100 hours exposure from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber. (a) 100X magnification, (b) 250X magnification, and (c) 500X magnification., and (d) 2000X magnification.

## **Appendix P**

# Scanning Electron Microscopy Images of Bare Coupons

(Low UV and High Ozone Chamber)

# FIGURES

Page

Figure P-1. SEM images of pure silver sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm <sup>2</sup> ) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification. ....	8
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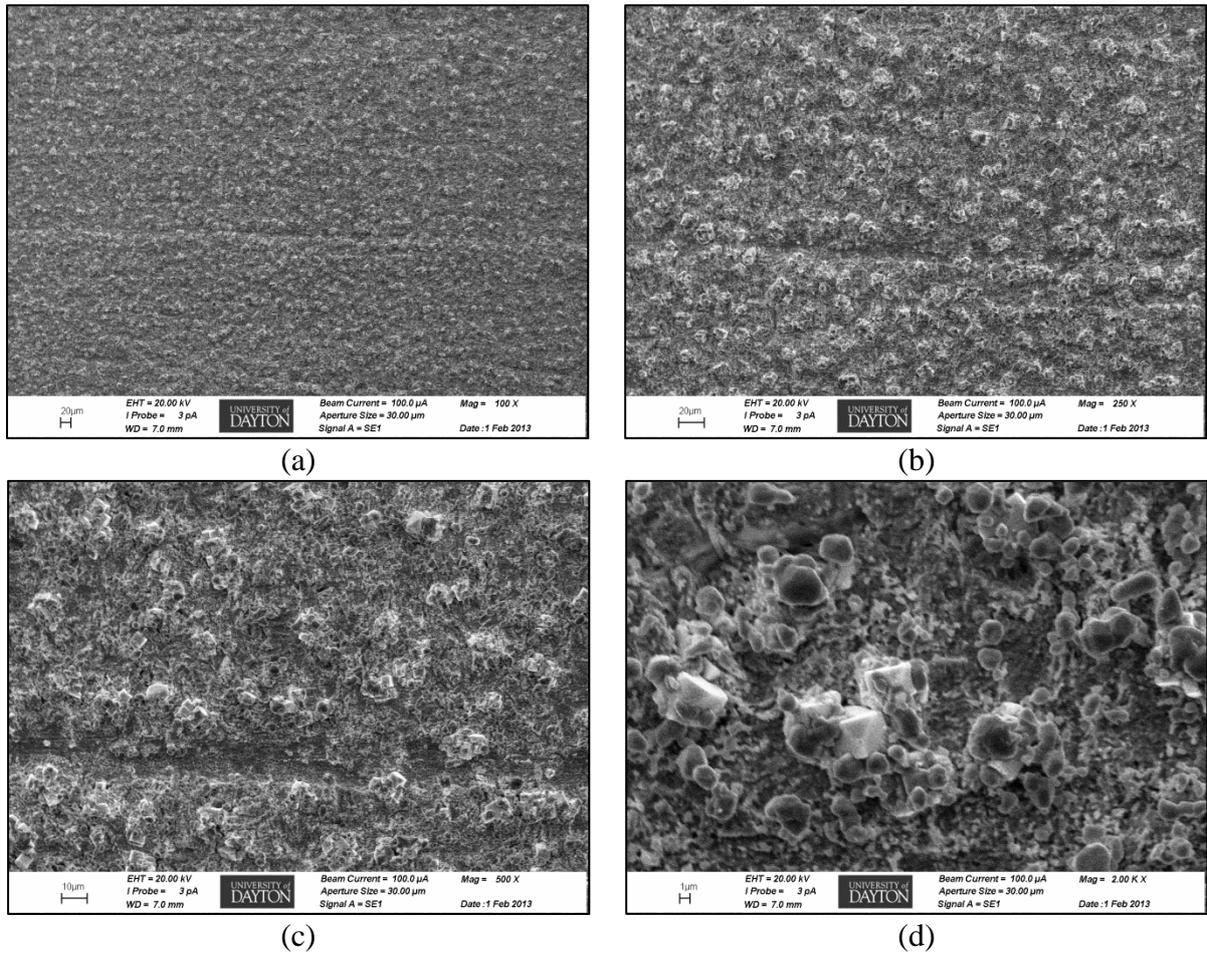
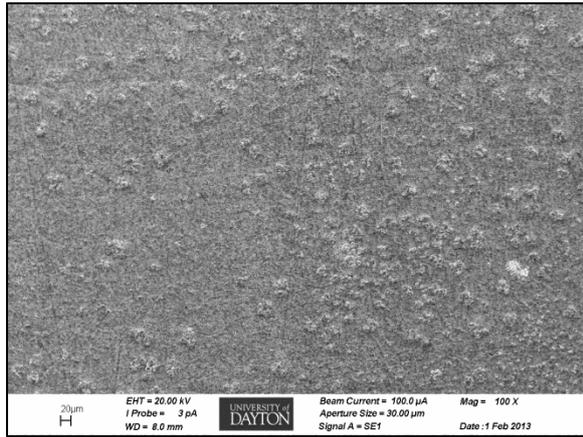
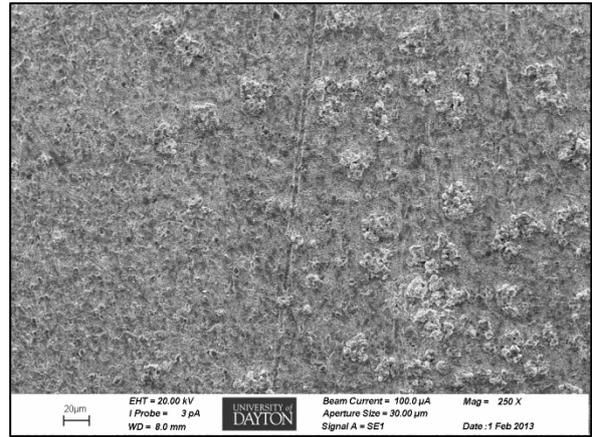


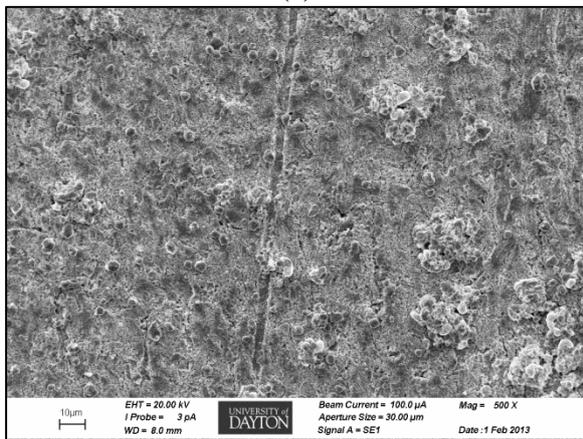
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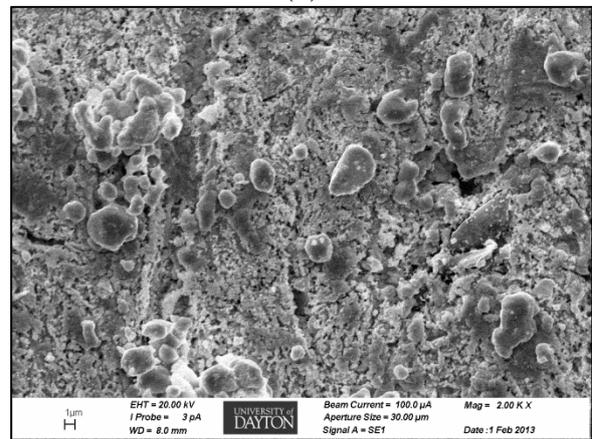
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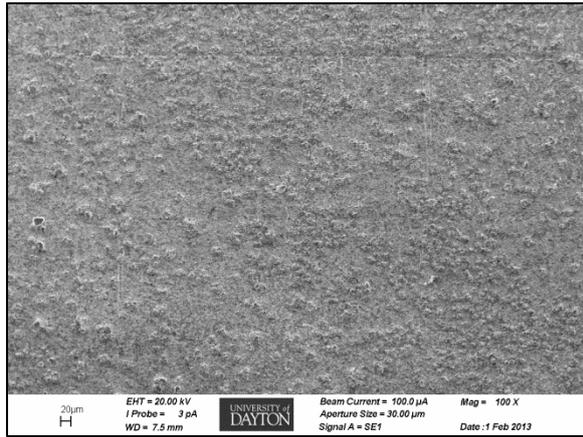


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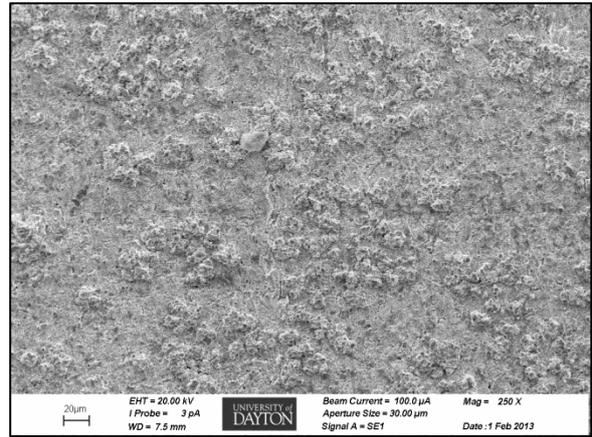


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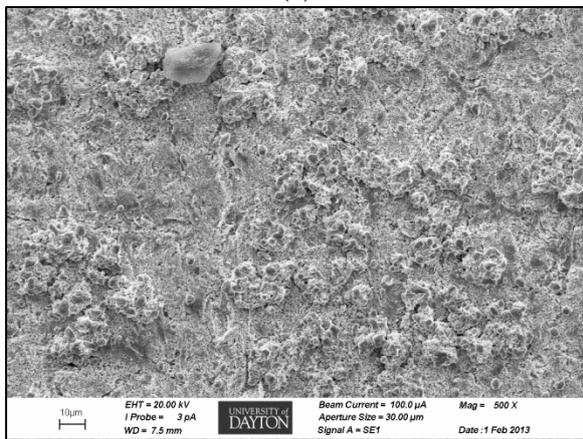
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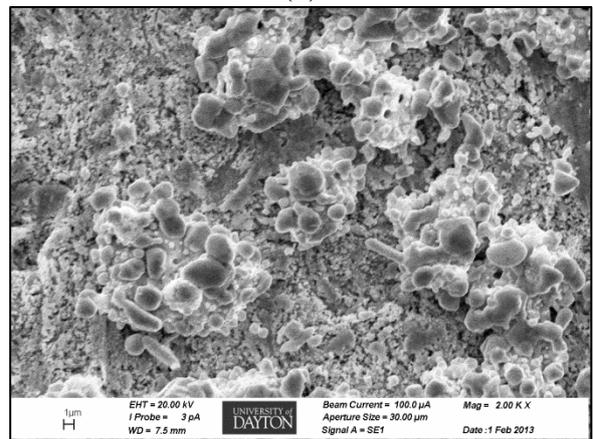
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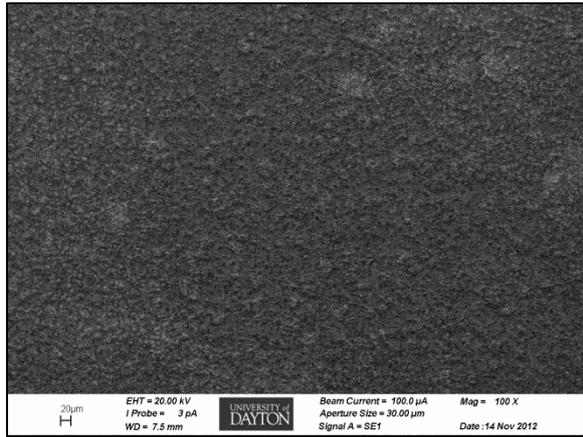


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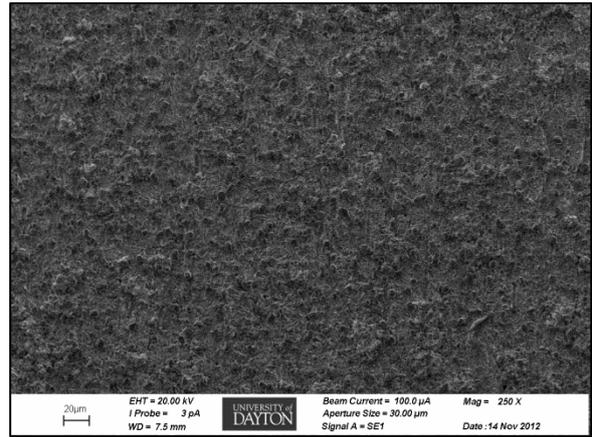


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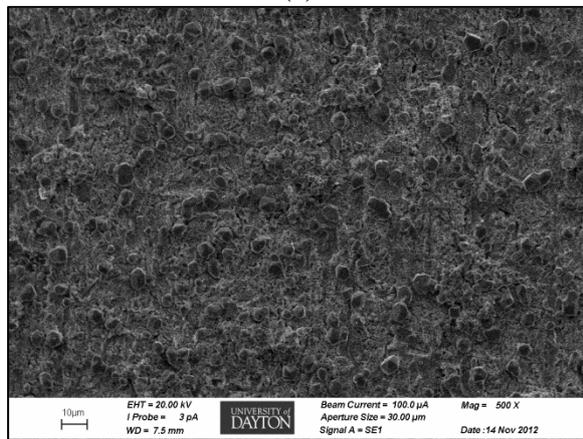
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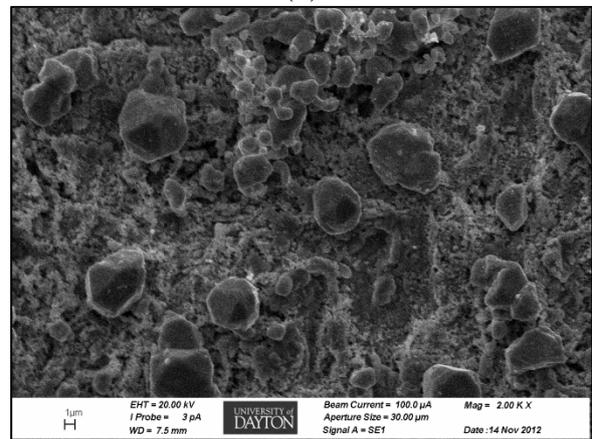
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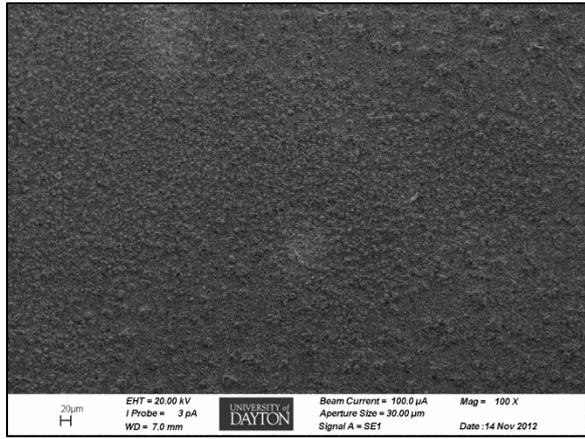


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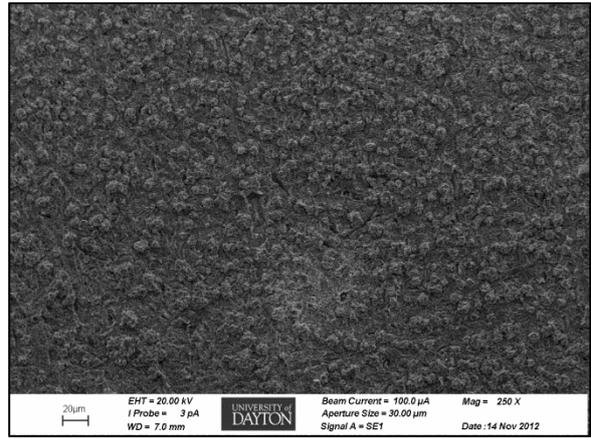


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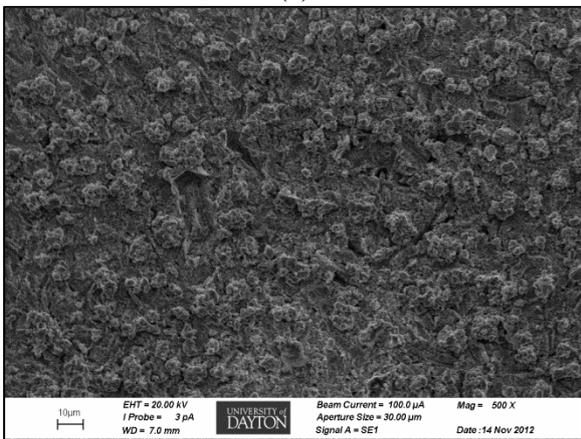
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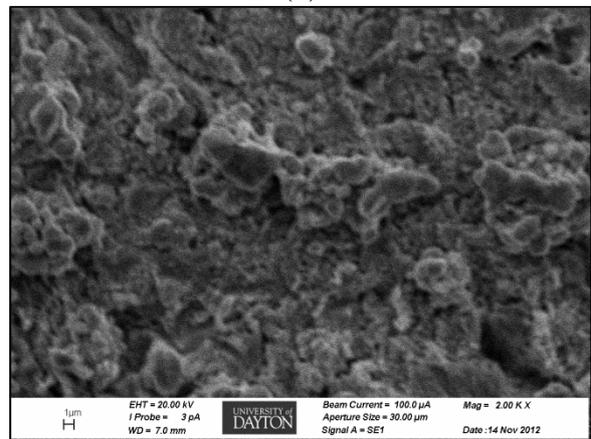
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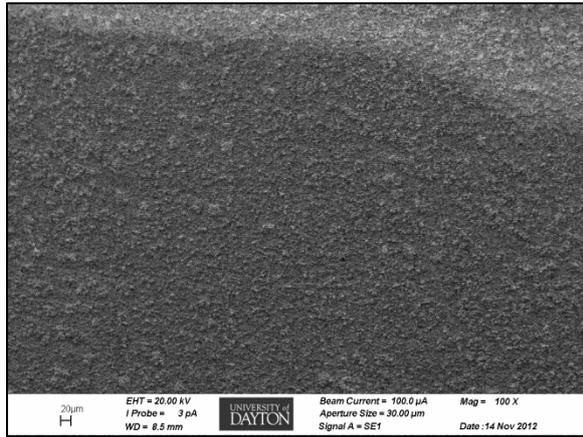


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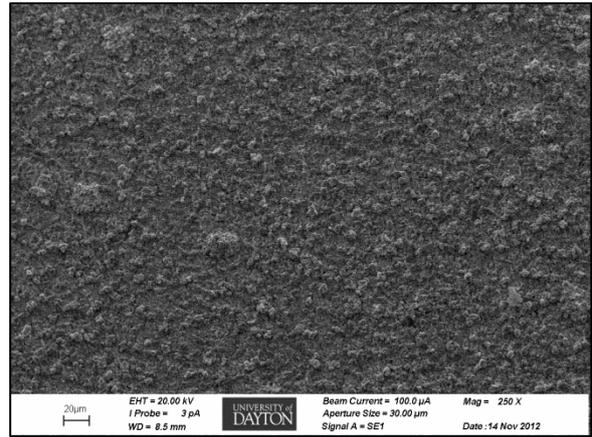


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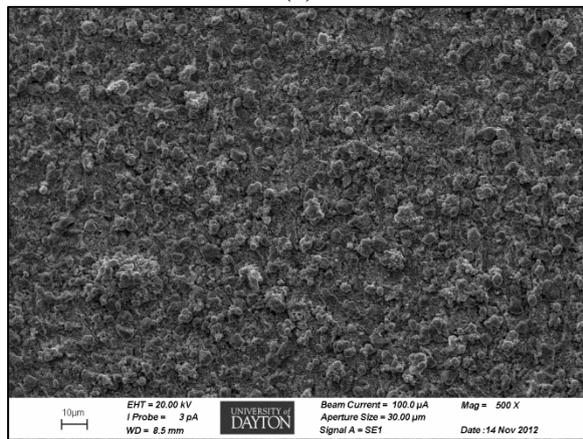
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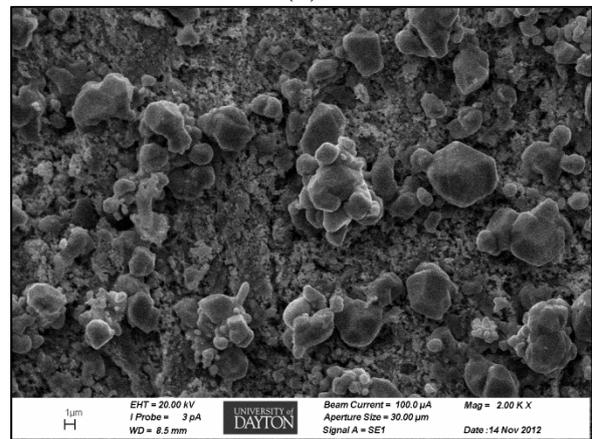
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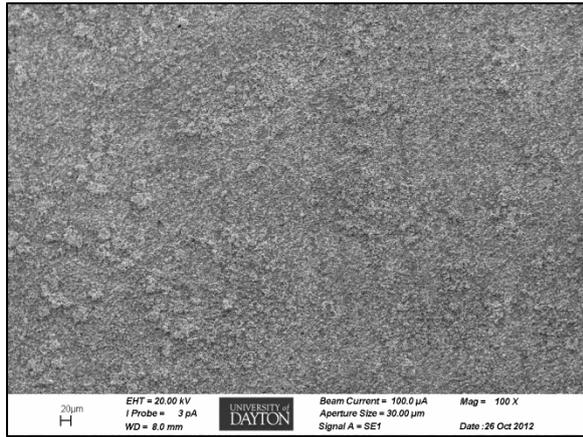


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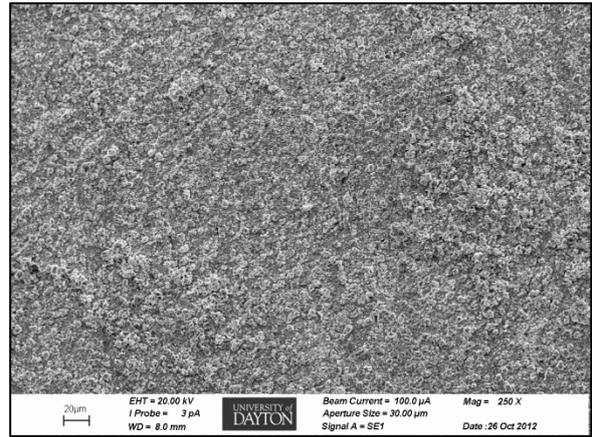


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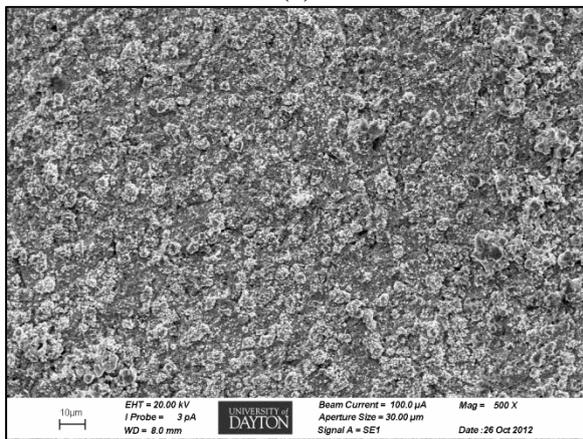
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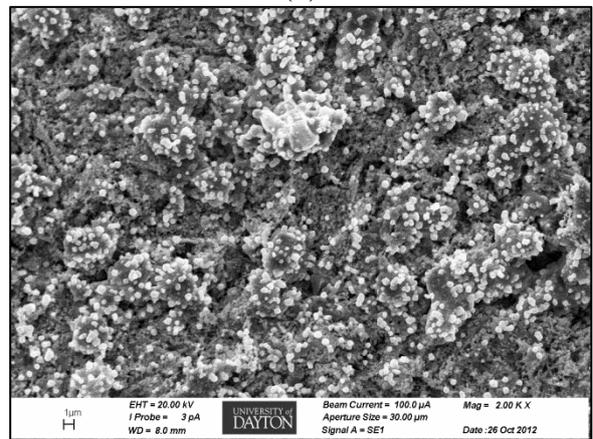
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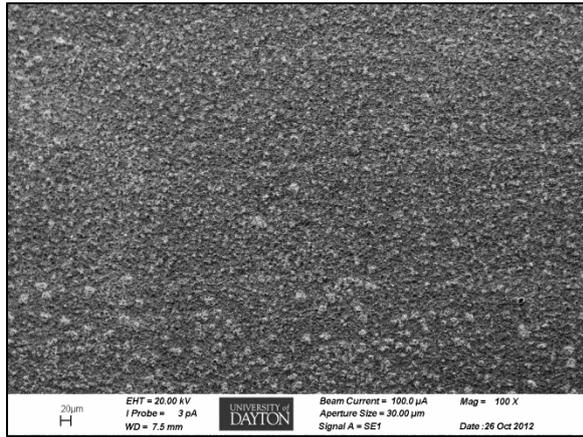


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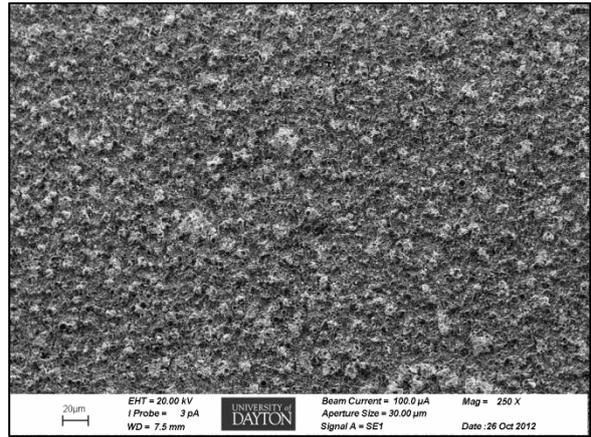


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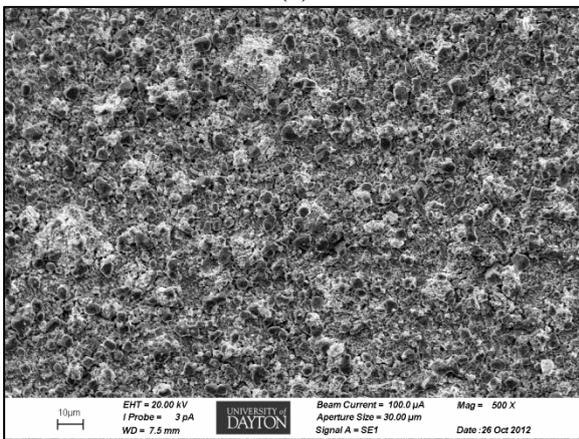
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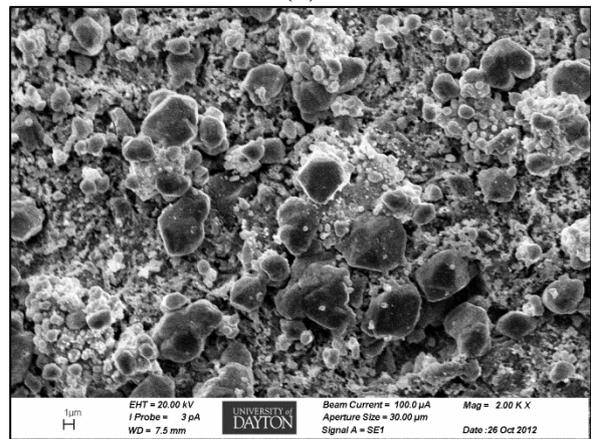
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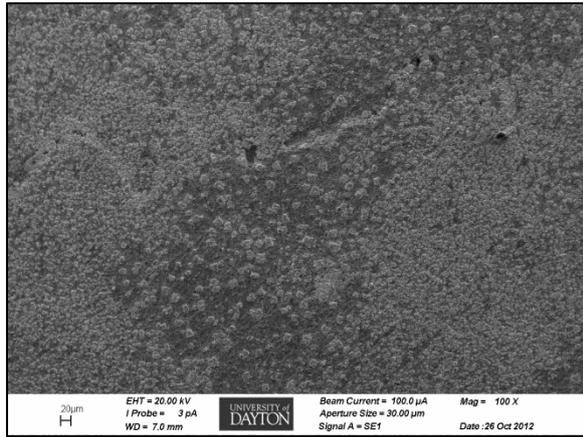


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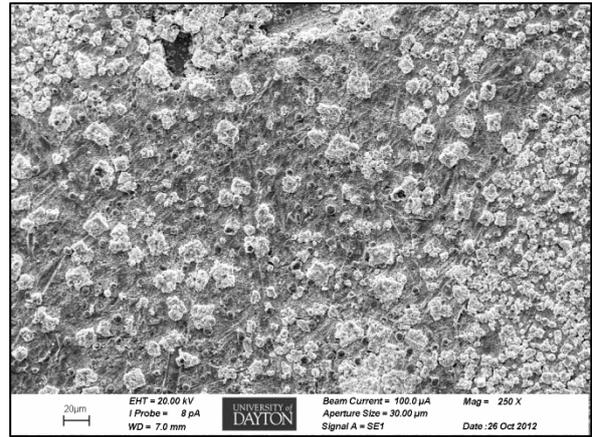


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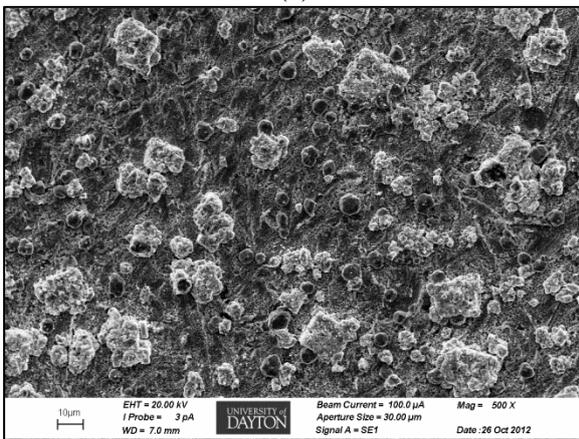
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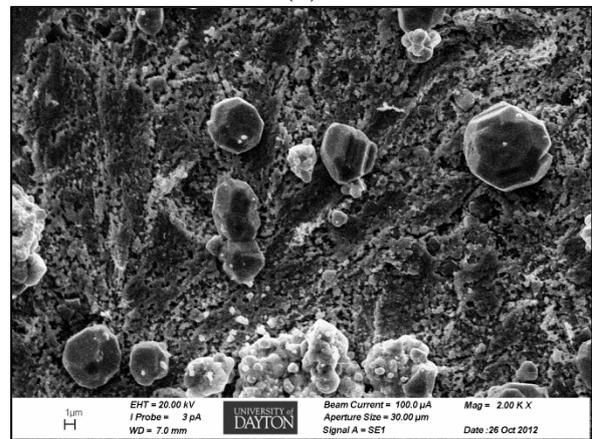
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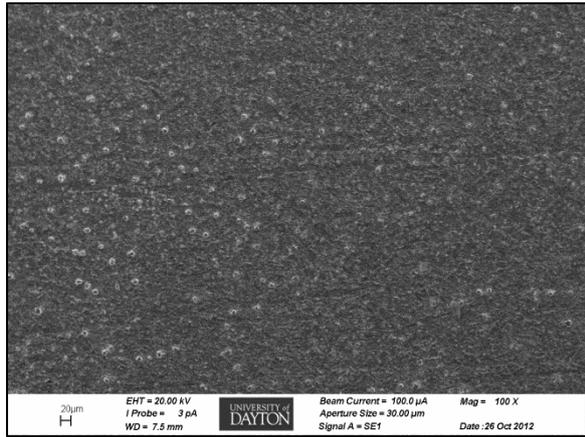


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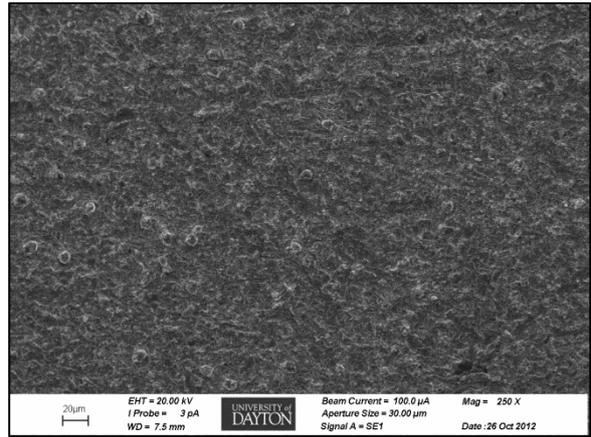


(d)

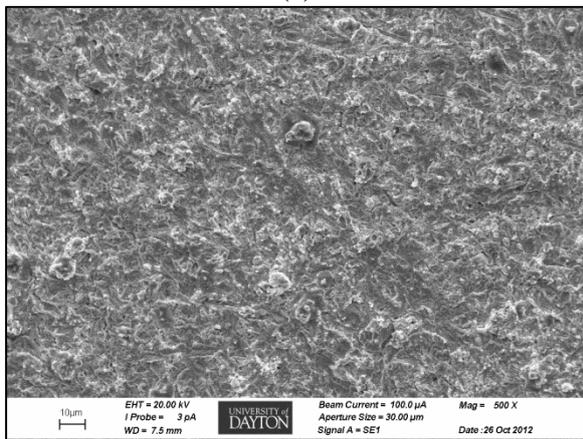
Figure P-9. SEM images of pure silver sample retrieved on 200 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 1000X magnification.



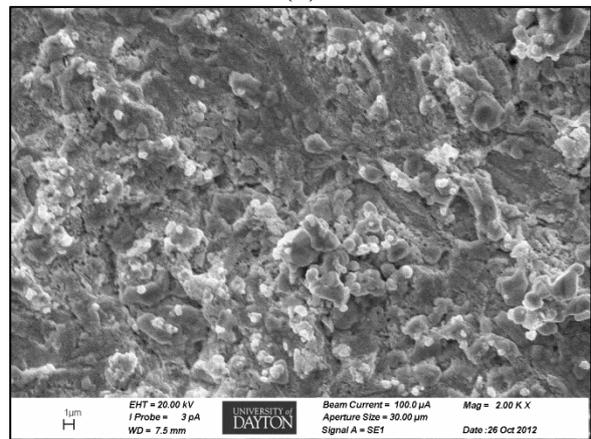
(a)



(b)

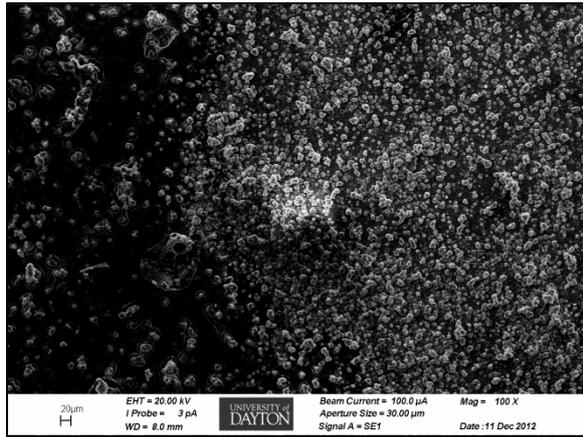


(c)

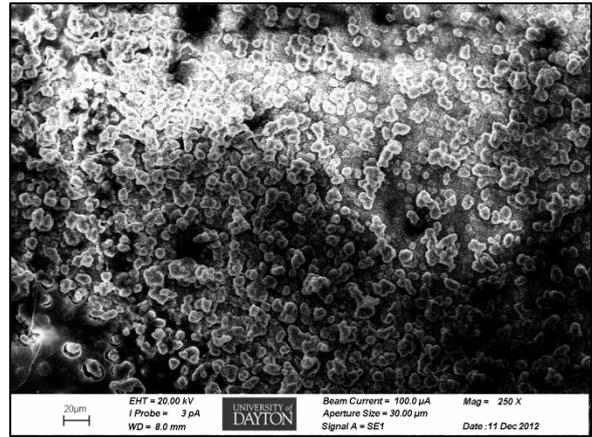


(d)

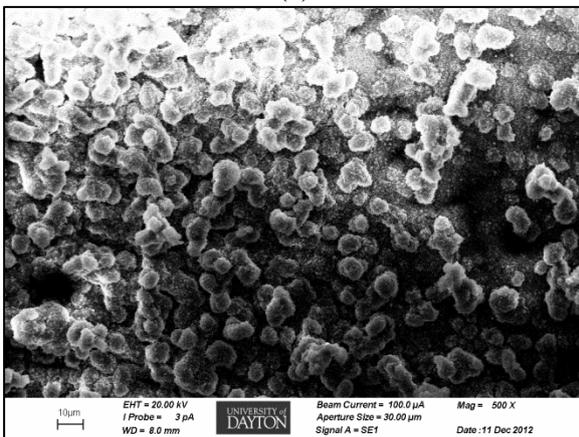
Figure P-0. SEM images of pure silver sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 1000X magnification.



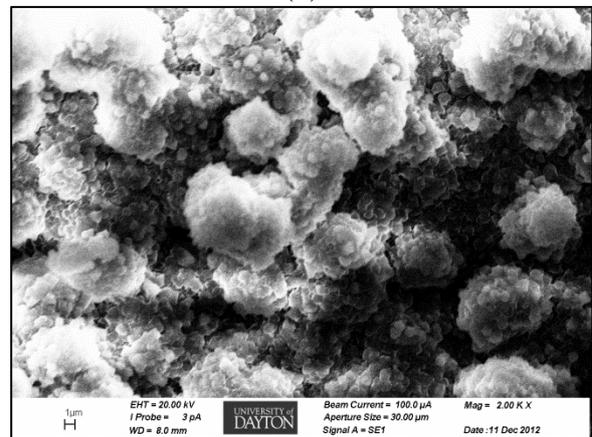
(a)



(b)

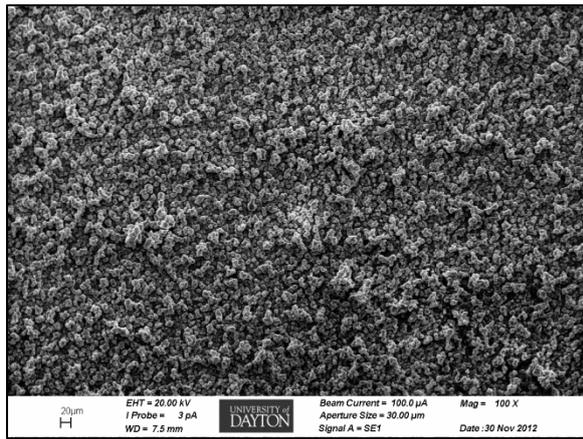


(c)

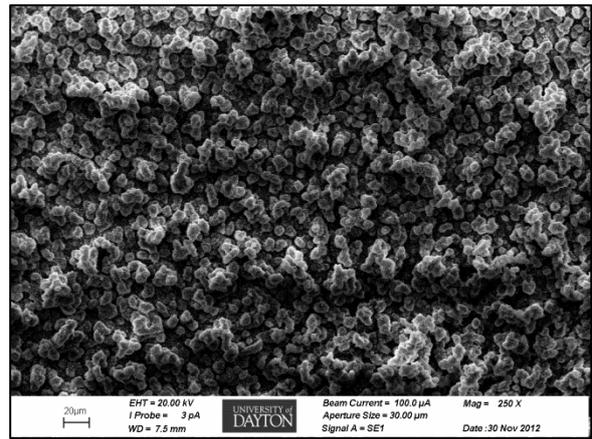


(d)

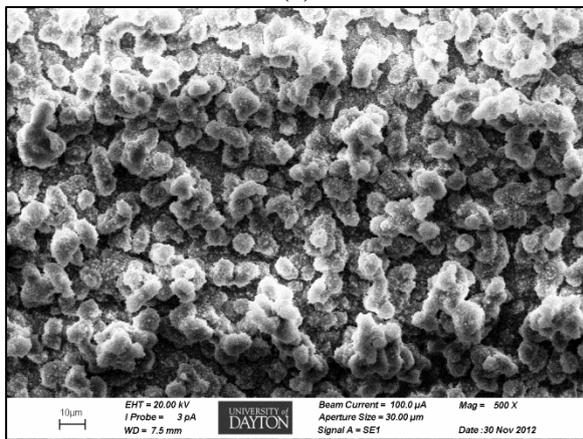
Figure P-11. SEM images of aluminum alloy 7075 sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



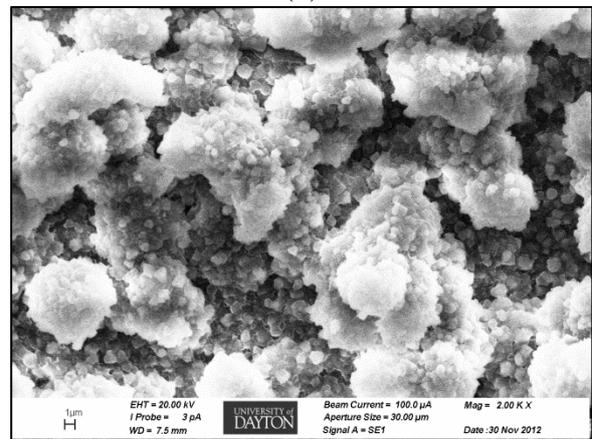
(a)



(b)

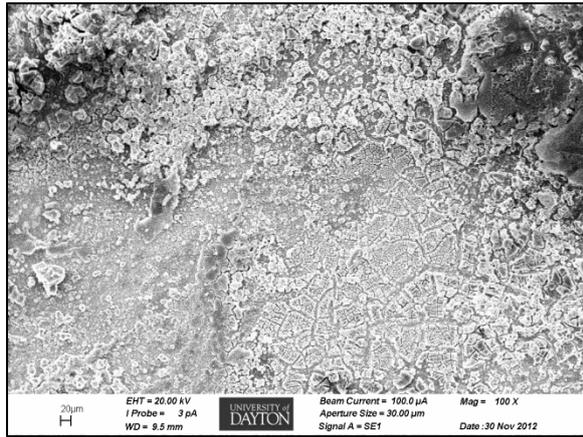


(c)

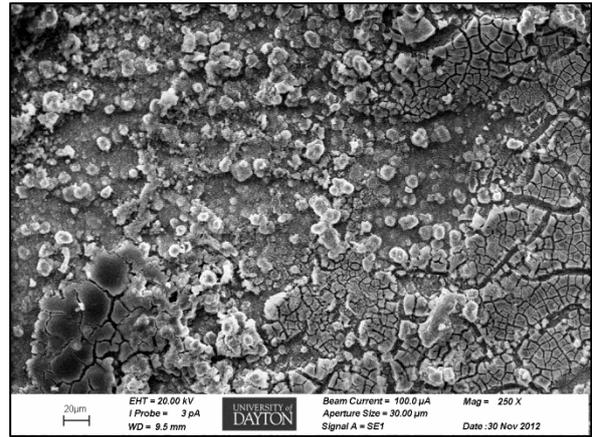


(d)

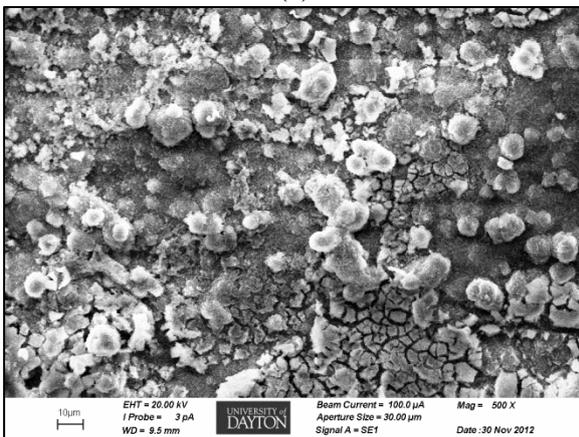
Figure P-12. SEM images of aluminum alloy 7075 sample retrieved on 900 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



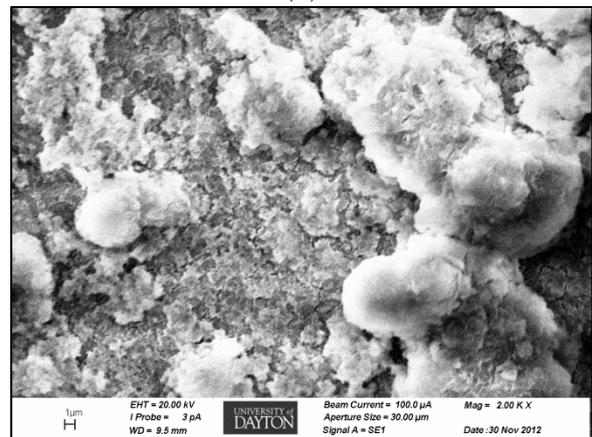
(a)



(b)

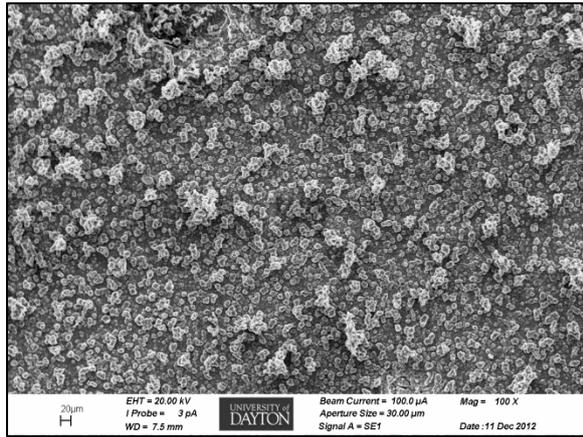


(c)

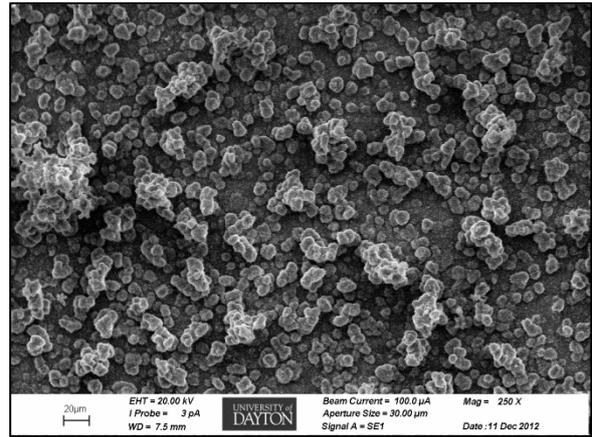


(d)

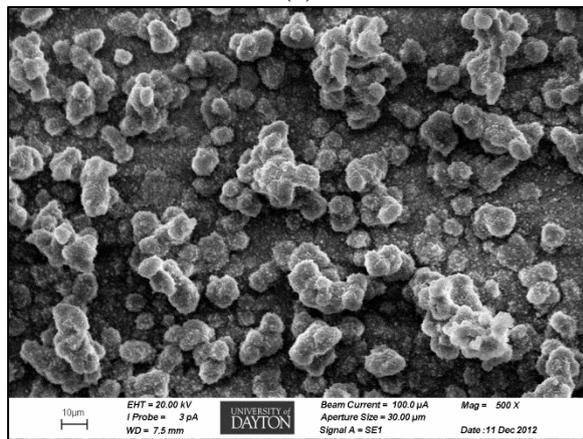
Figure P-13. SEM images of aluminum alloy 7075 sample retrieved on 800 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



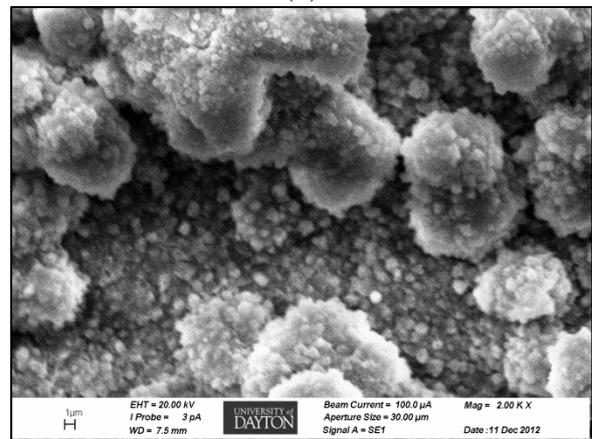
(a)



(b)

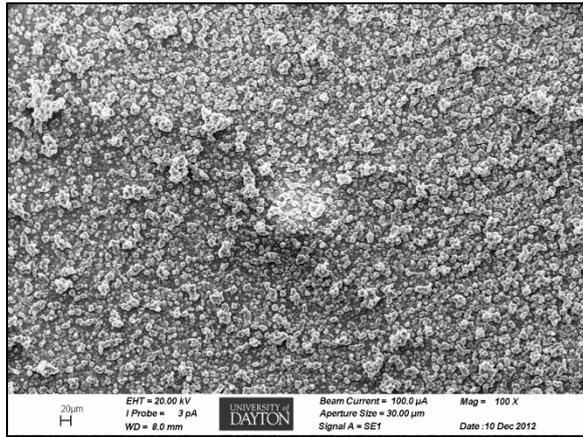


(c)

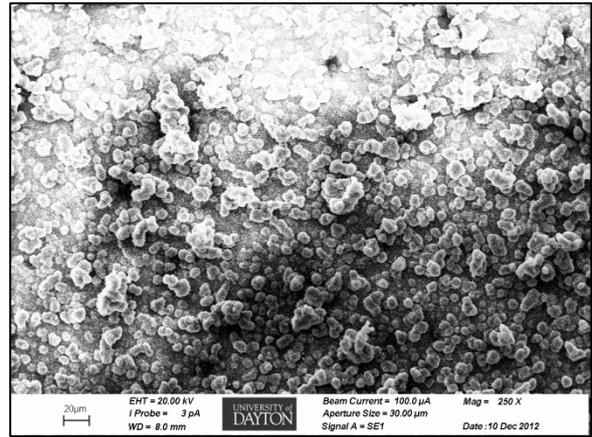


(d)

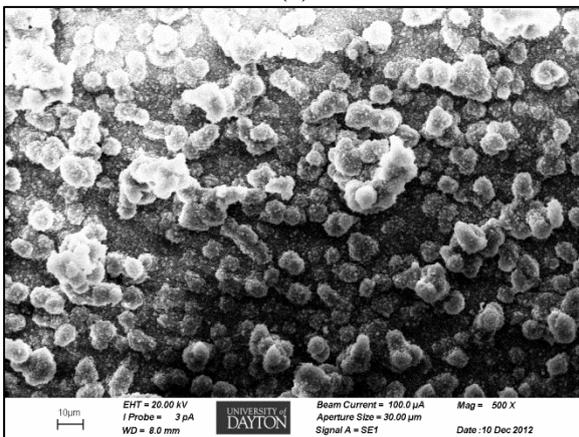
Figure P-14. SEM images of aluminum alloy 7075 sample retrieved on 700 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



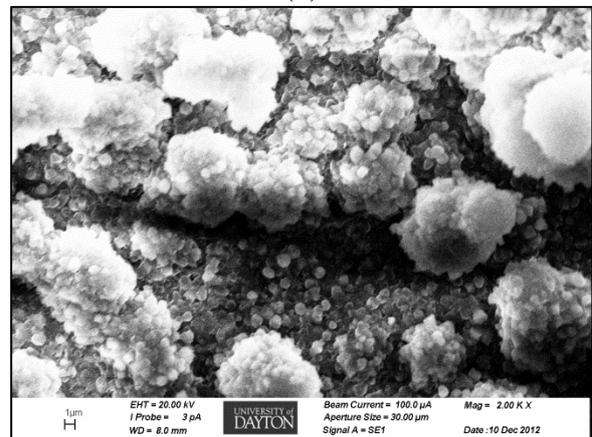
(a)



(b)

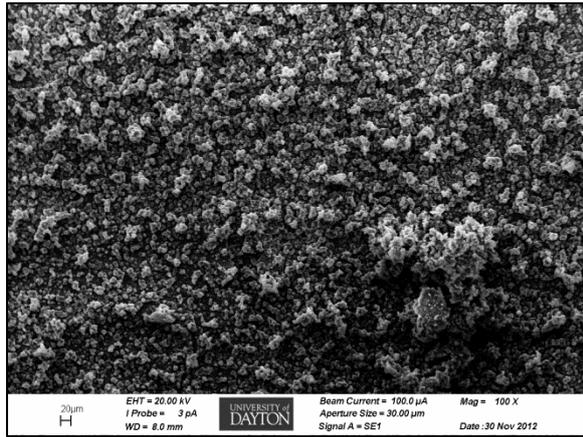


(c)

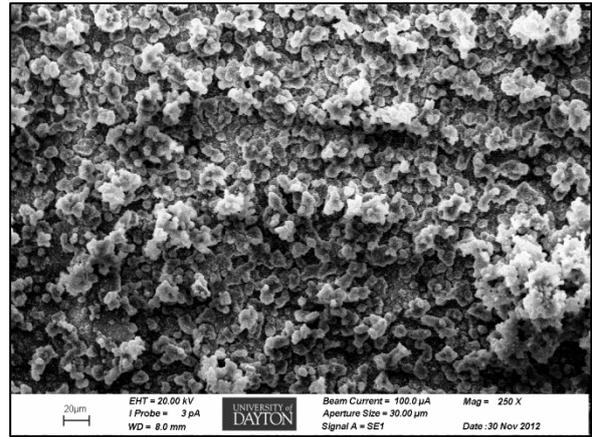


(d)

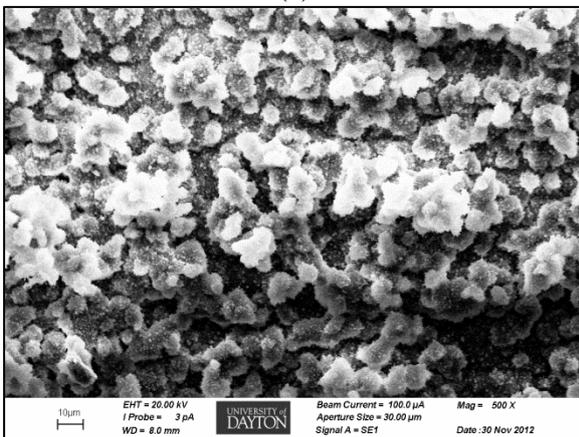
Figure P-15. SEM images of aluminum alloy 7075 sample retrieved on 600 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



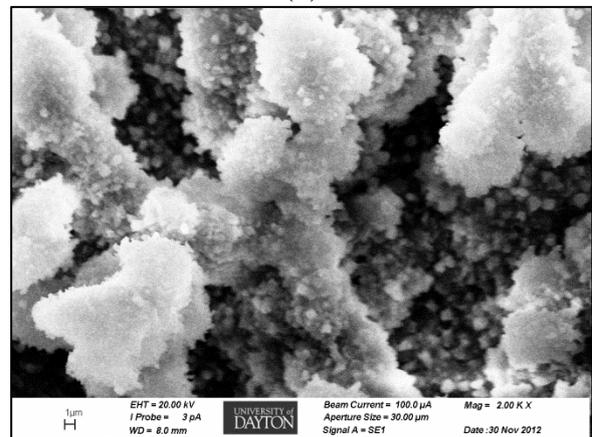
(a)



(b)

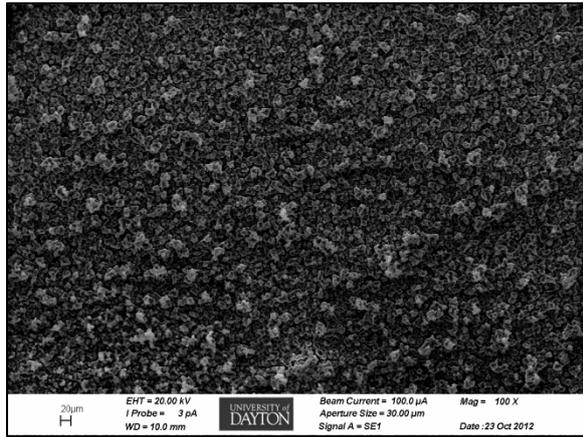


(c)

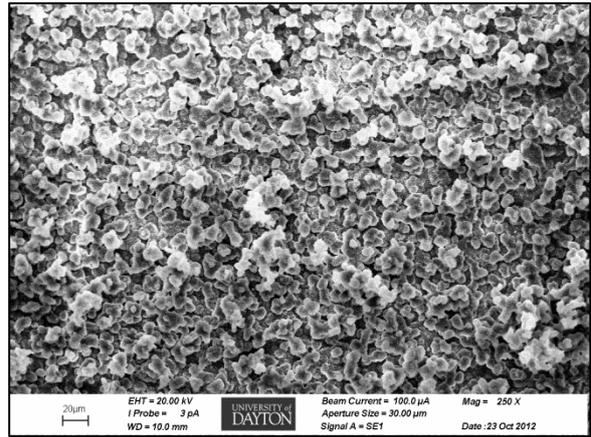


(d)

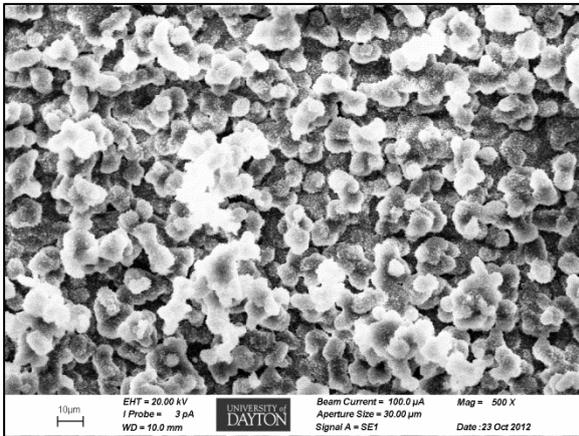
Figure P-16. SEM images of aluminum alloy 7075 sample retrieved on 500 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



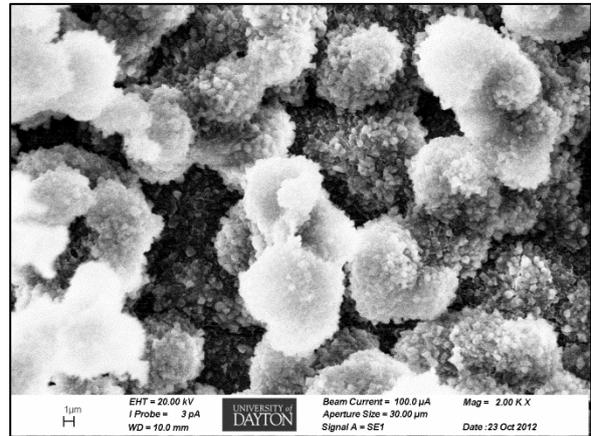
(a)



(b)

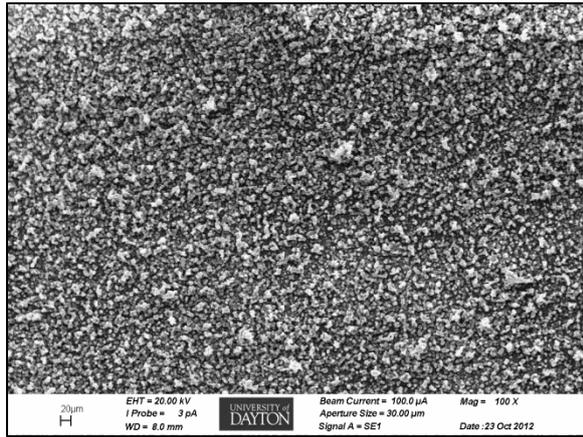


(c)

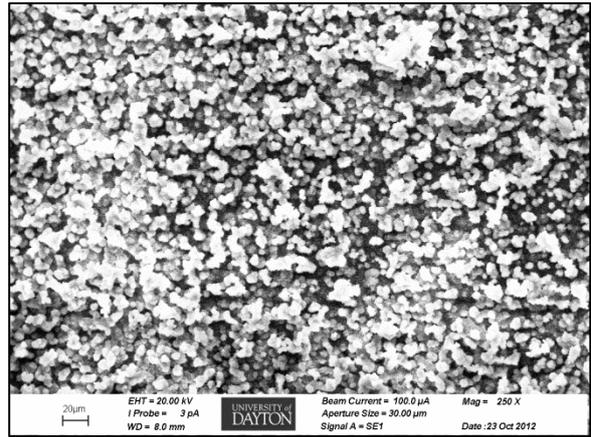


(d)

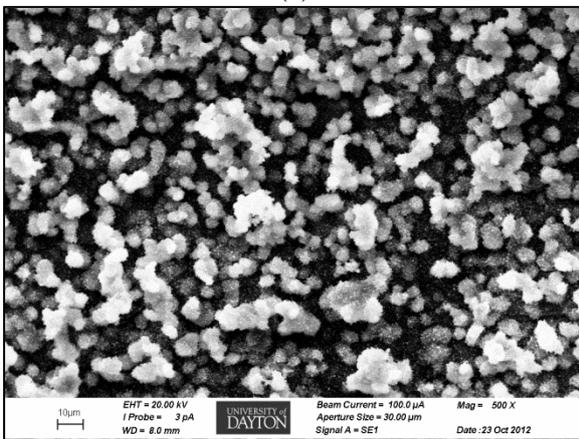
Figure P-17. SEM images of aluminum alloy 7075 sample retrieved on 400 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 2000X magnification



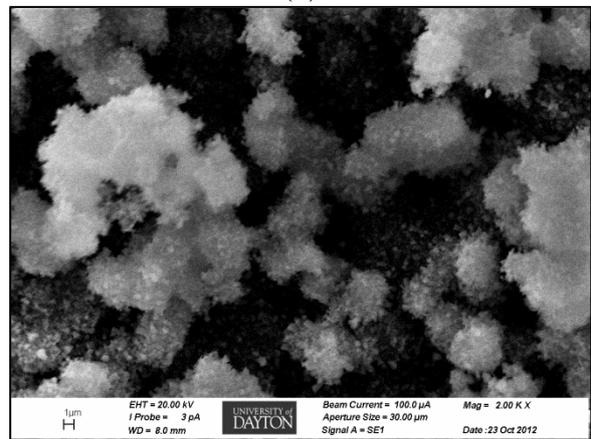
(a)



(b)

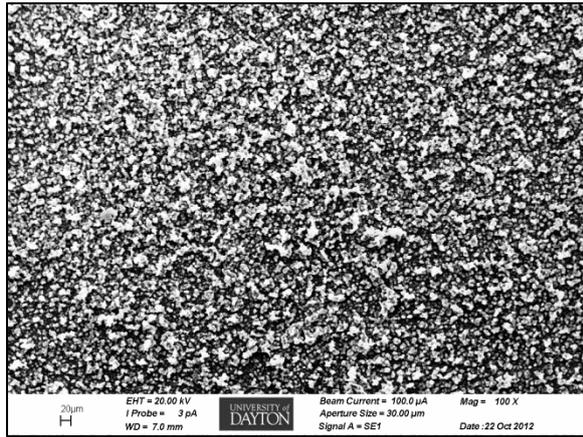


(c)

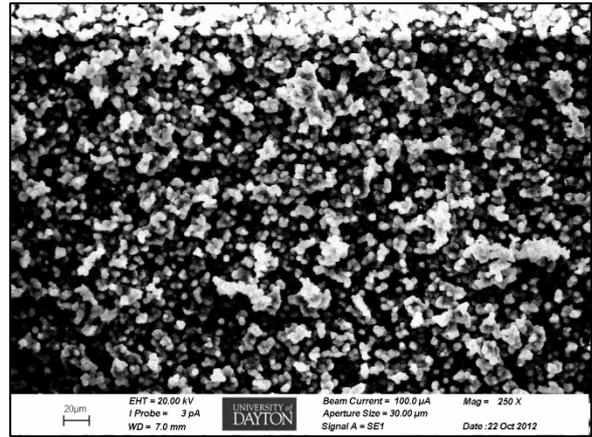


(d)

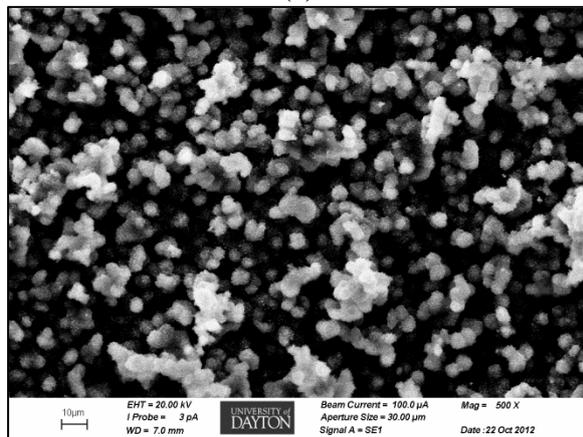
Figure P-18. SEM images of aluminum alloy 7075 sample retrieved on 300 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



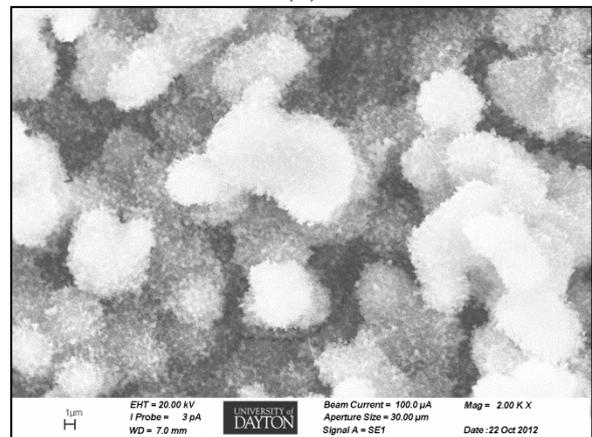
(a)



(b)

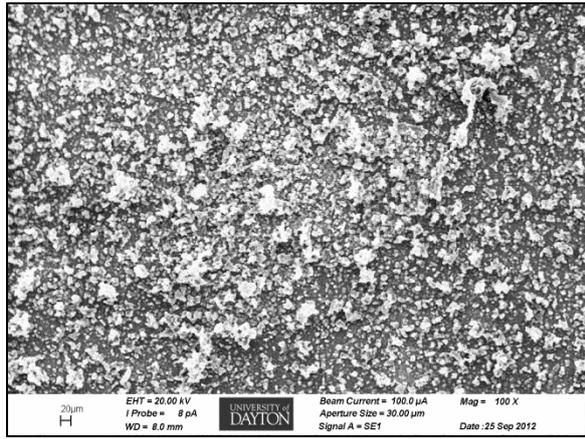


(c)

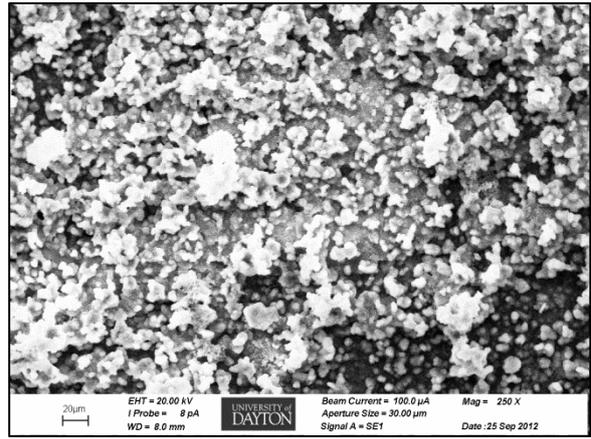


(d)

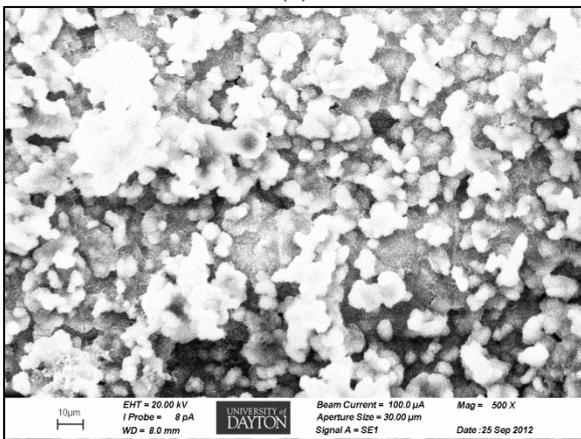
Figure P-19. SEM images of aluminum alloy 7075 sample retrieved on 200 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification and (d) 2000X magnification



(a)



(b)



(c)

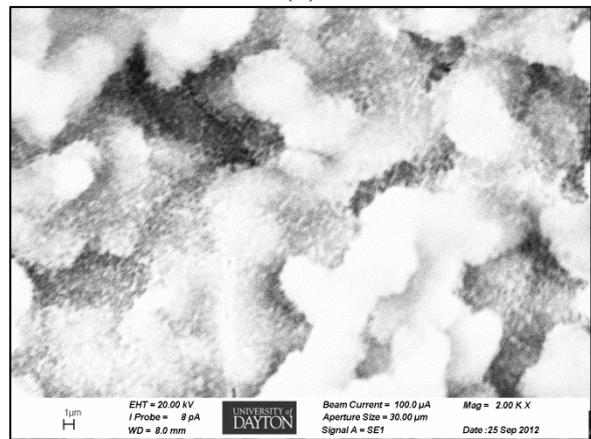
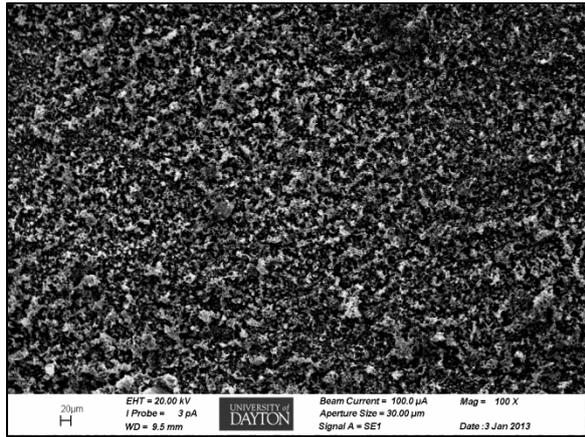
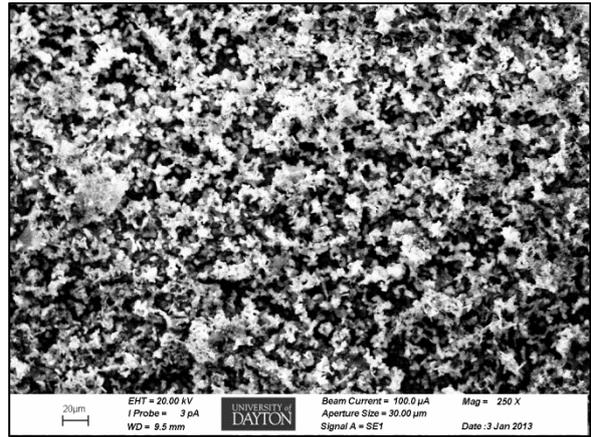


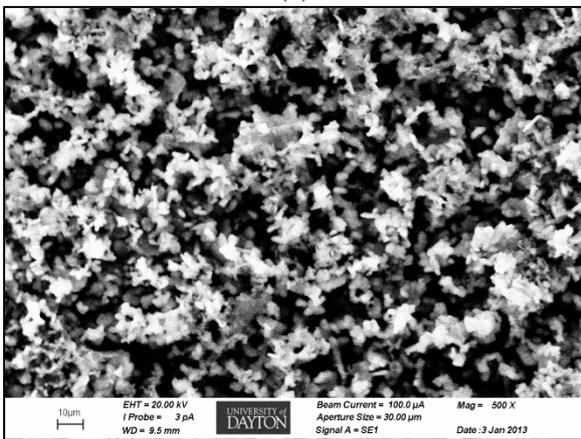
Figure P-20. SEM images of aluminum alloy 7075 sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



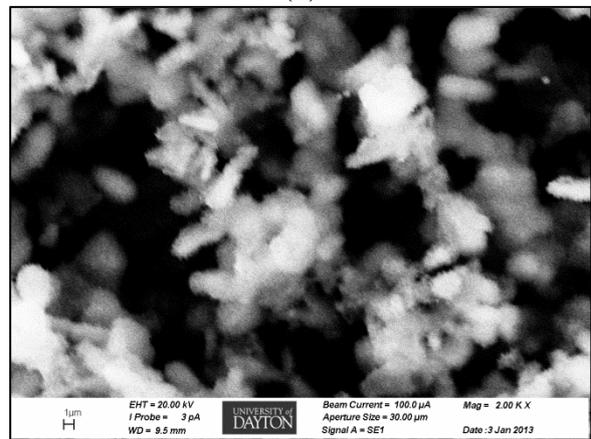
(a)



(b)

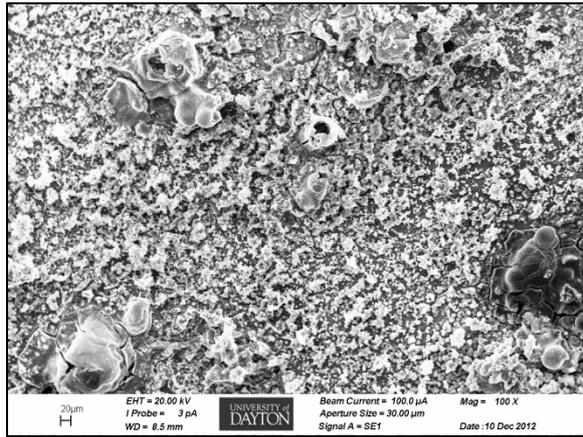


(c)

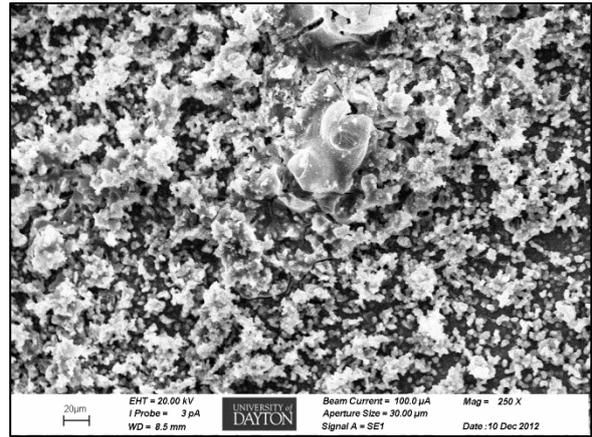


(d)

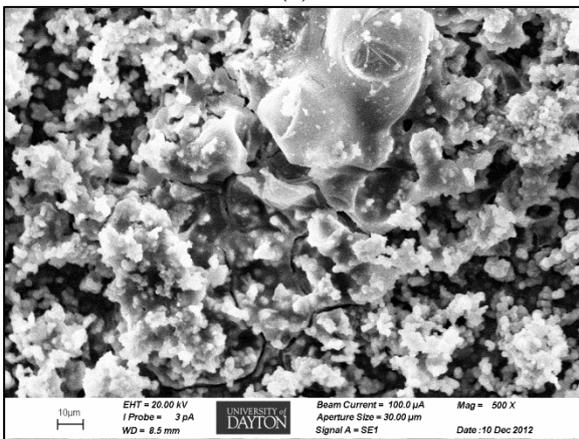
Figure P-2. SEM images of aluminum alloy 6061 sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



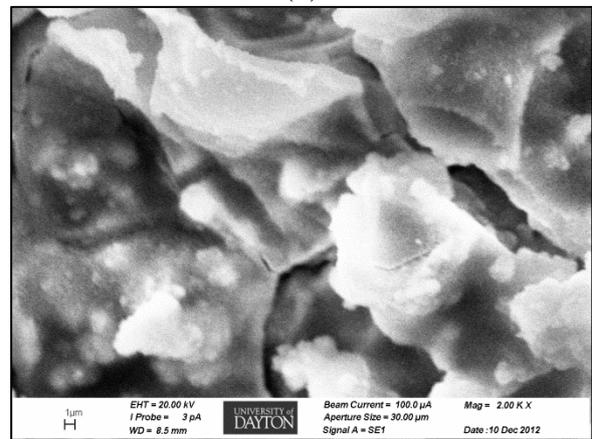
(a)



(b)

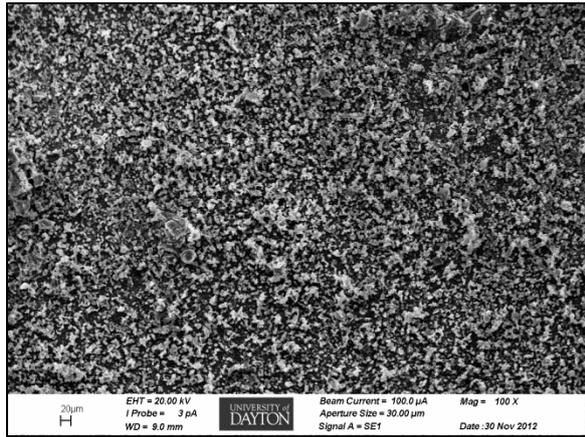


(c)

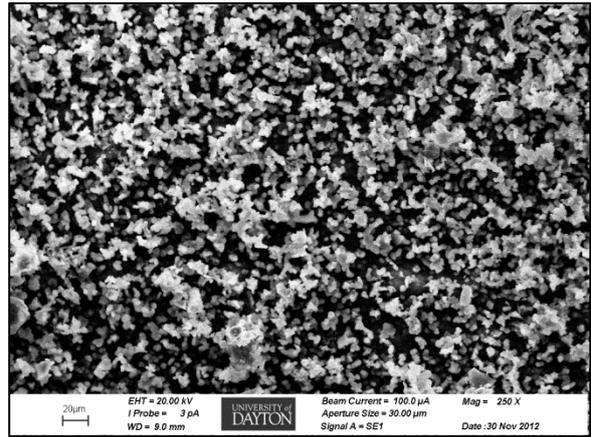


(d)

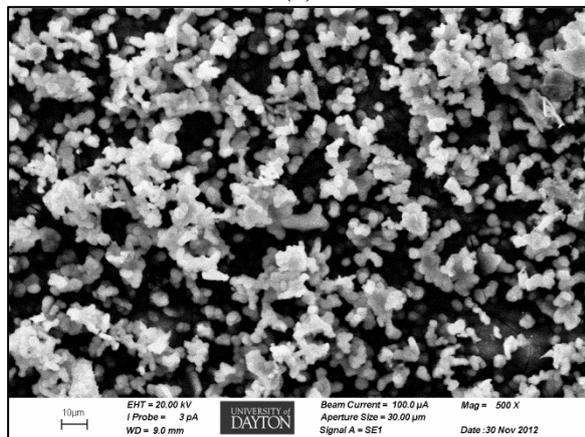
Figure P-3. SEM images of aluminum alloy 6061 sample retrieved on 900 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



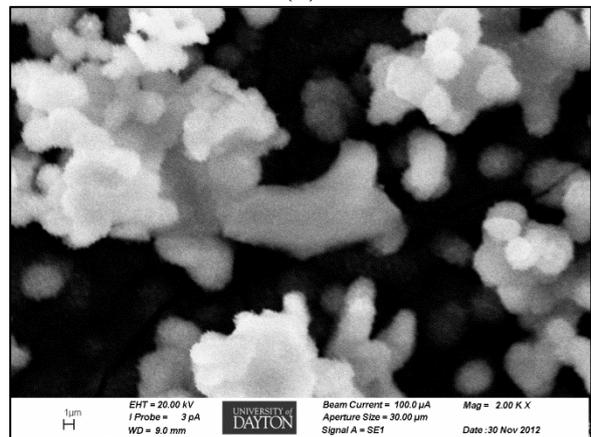
(a)



(b)

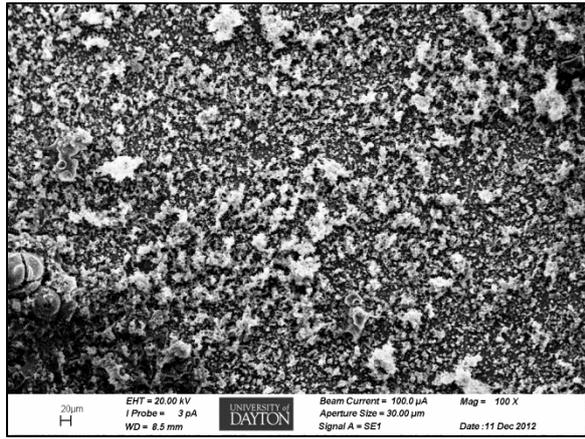


(c)

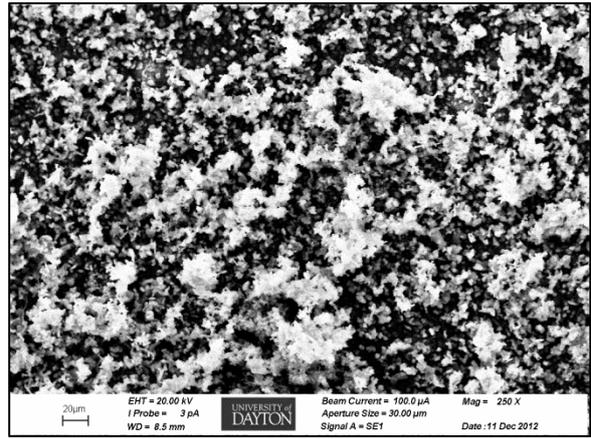


(d)

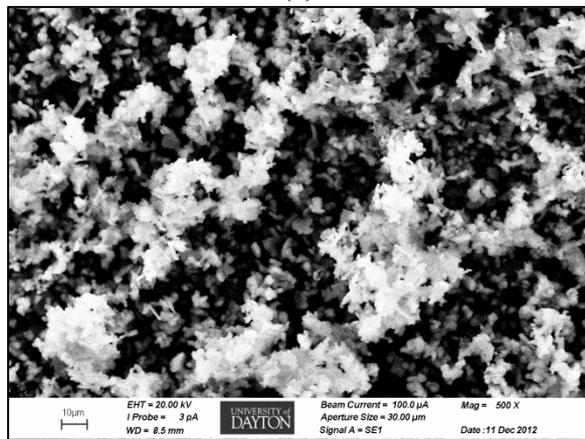
Figure P-4. SEM images of aluminum alloy 6061 sample retrieved on 800 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



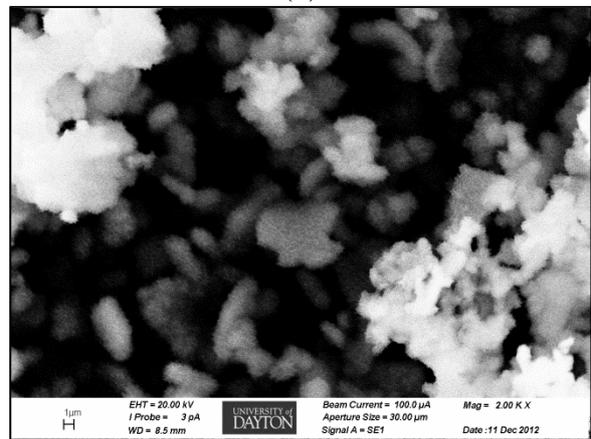
(a)



(b)

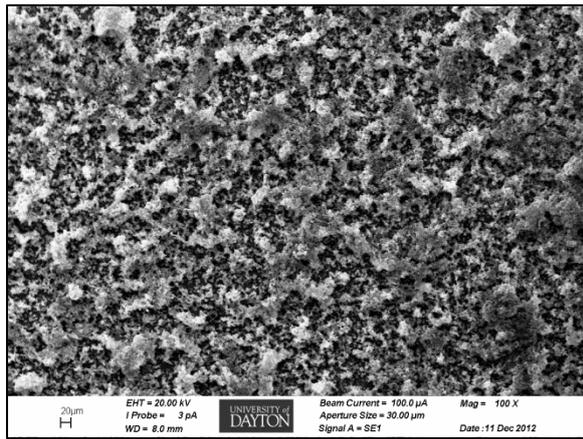


(c)

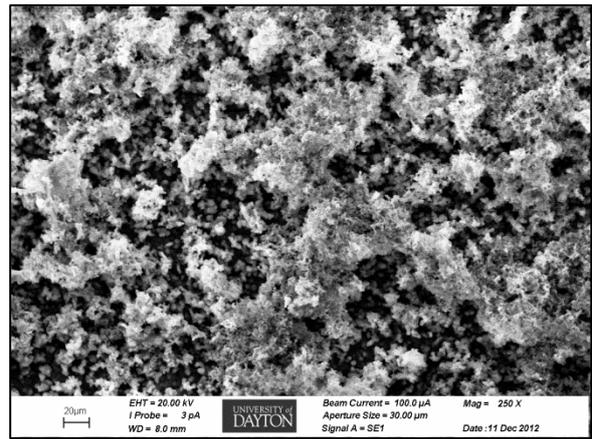


(d)

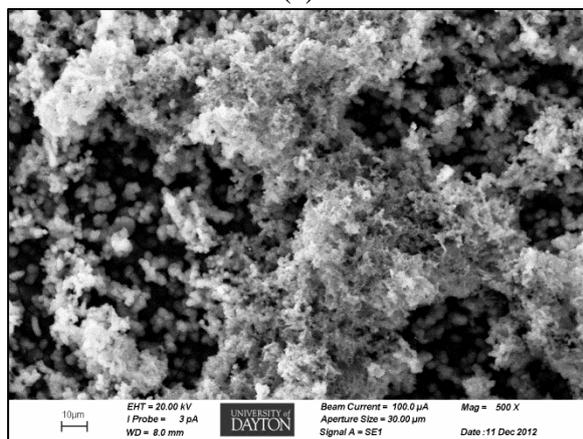
Figure P-5. SEM images of aluminum alloy 6061 sample retrieved on 700 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



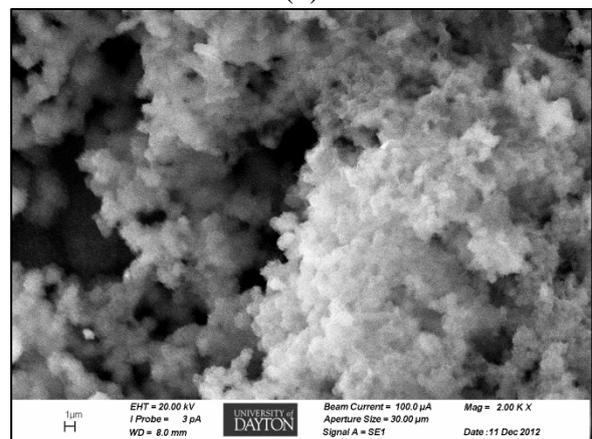
(a)



(b)

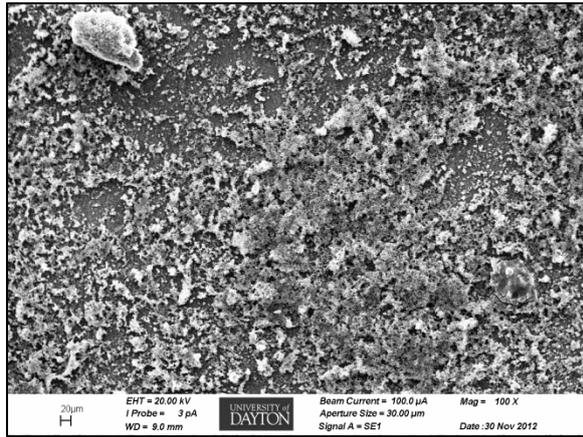


(c)

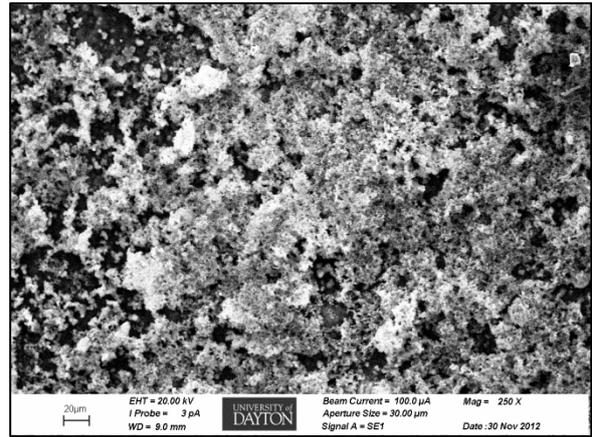


(d)

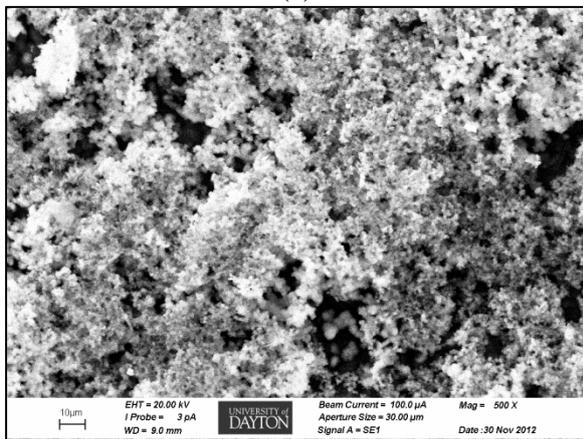
Figure P-6. SEM images of aluminum alloy 6061 sample retrieved on 600 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



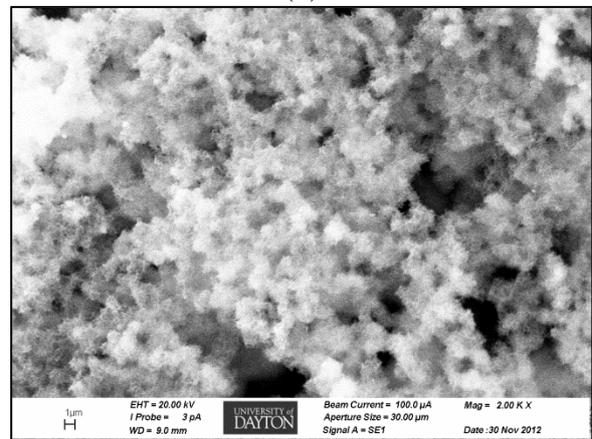
(a)



(b)

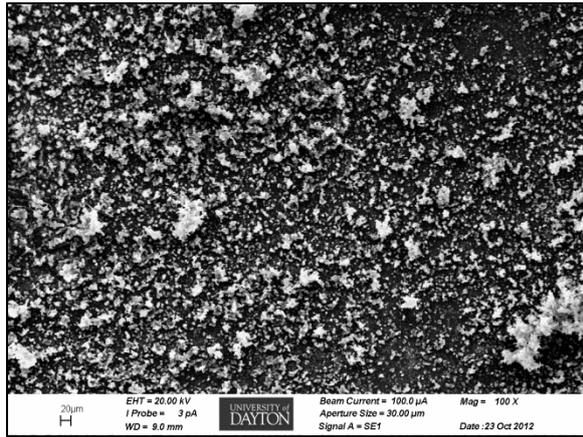


(c)

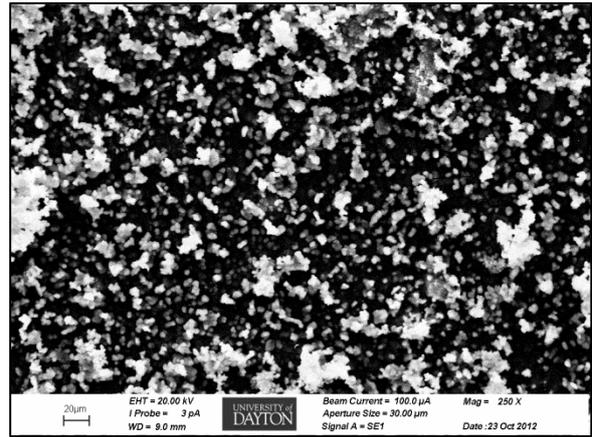


(d)

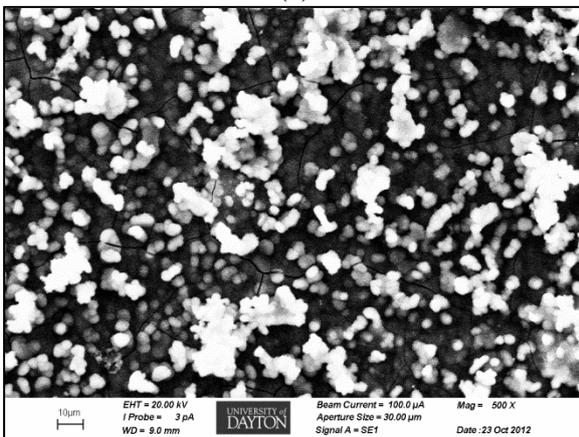
Figure P-7. SEM images of aluminum alloy 6061 sample retrieved on 500 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



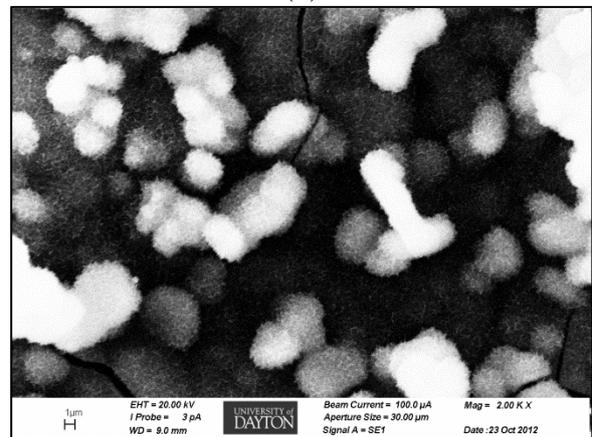
(a)



(b)

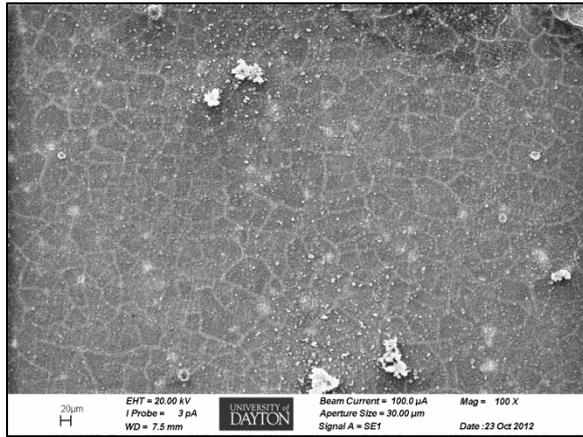


(c)

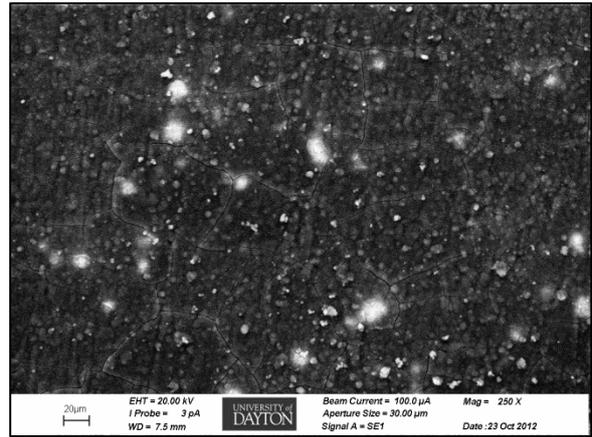


(d)

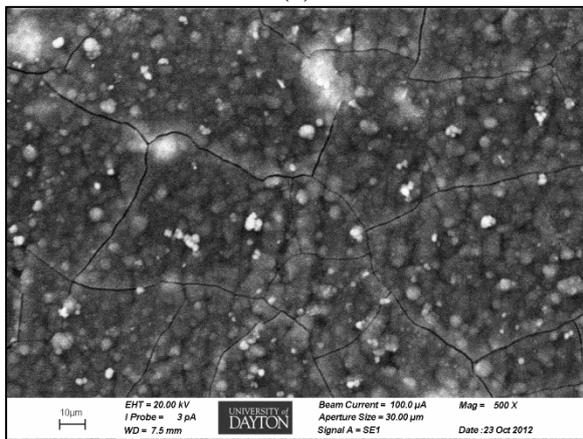
Figure P-8. SEM images of aluminum alloy 6061 sample retrieved on 400 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



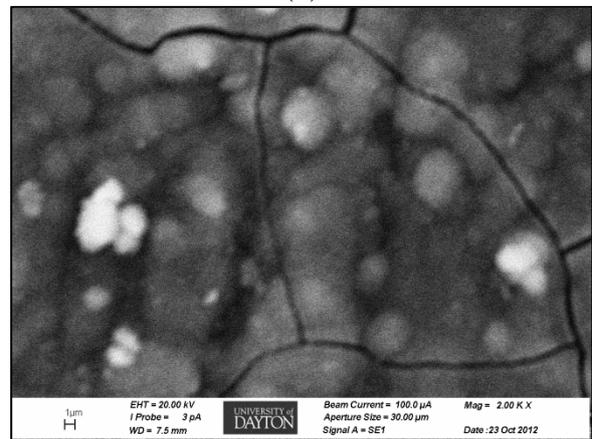
(a)



(b)

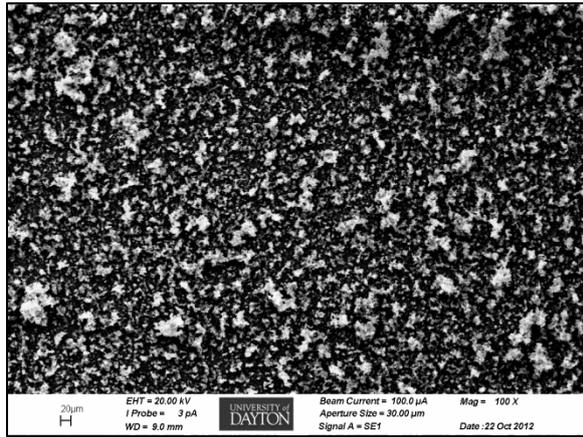


(c)

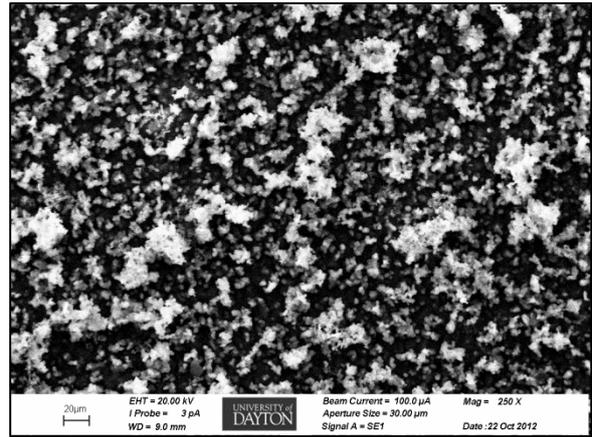


(d)

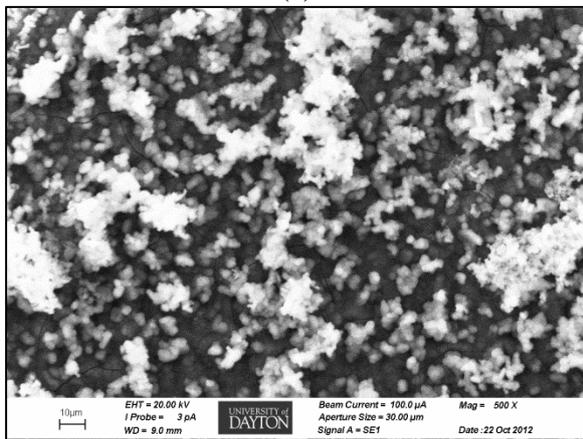
Figure P-9. SEM images of aluminum alloy 6061 sample retrieved on 300 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



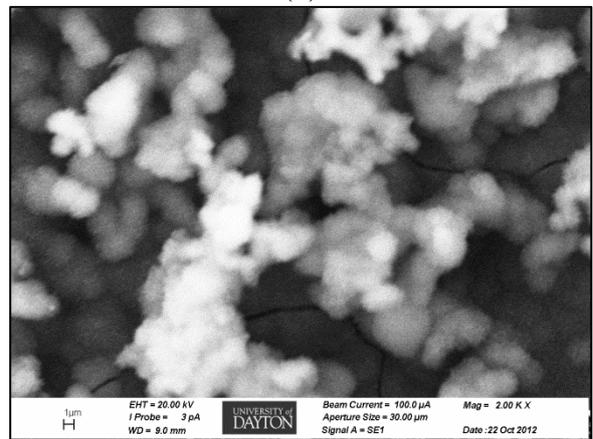
(a)



(b)

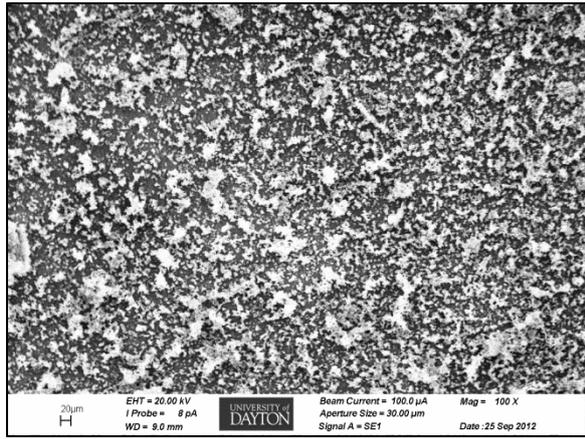


(c)

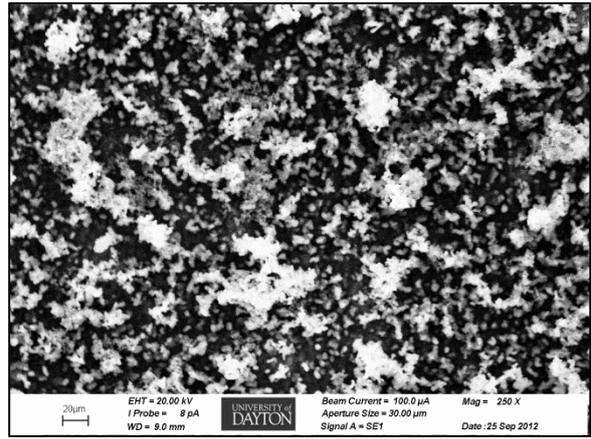


(d)

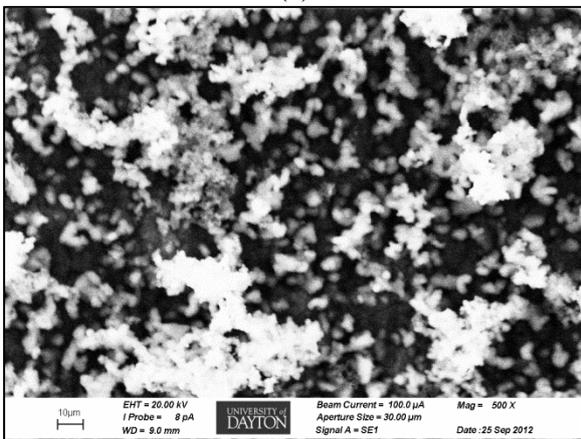
Figure P-10. SEM images of aluminum alloy 6061 sample retrieved on 200 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



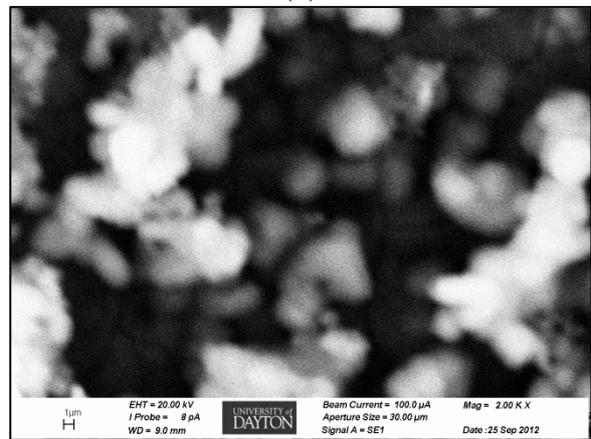
(a)



(b)

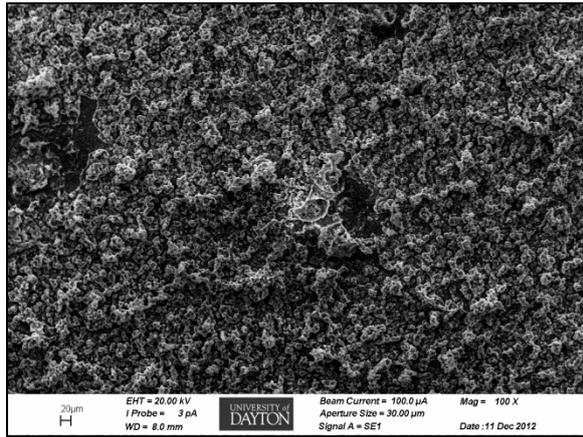


(c)

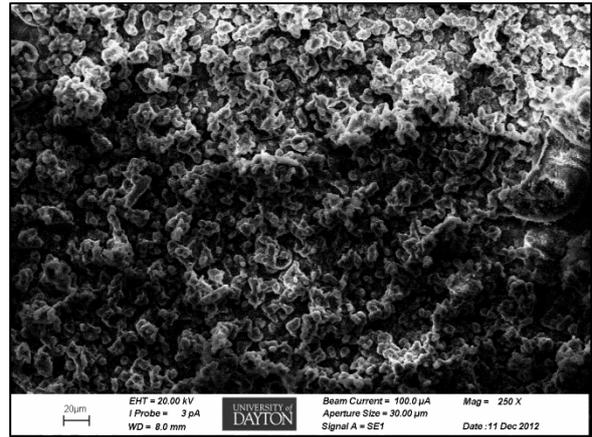


(d)

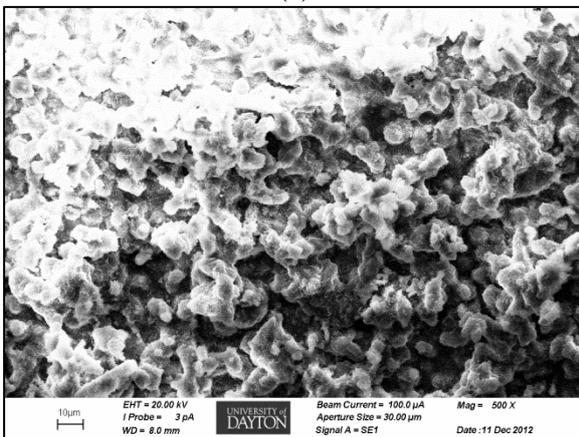
Figure P-11. SEM images of aluminum alloy 6061 sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



(a)



(b)



(c)

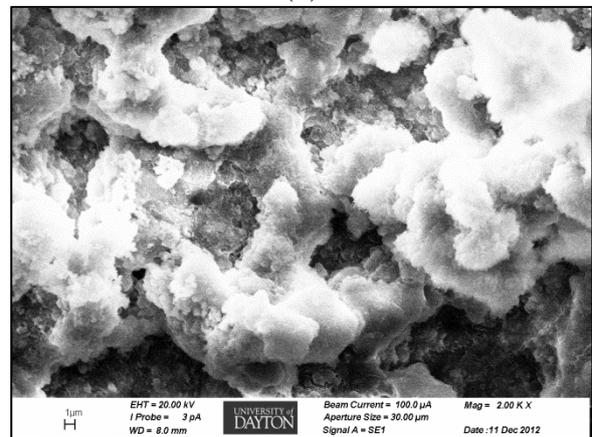
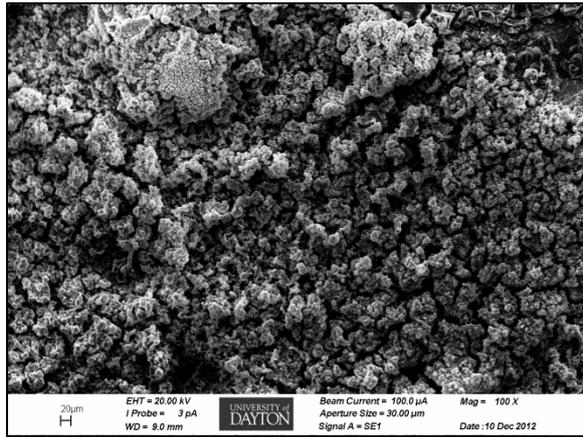
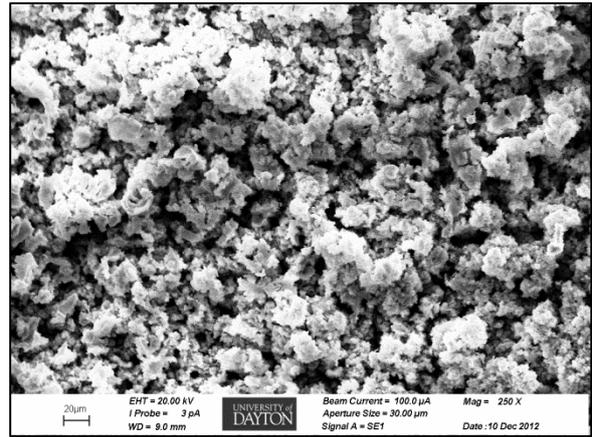


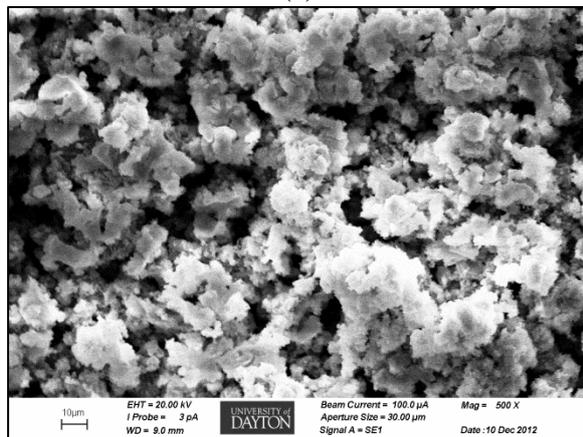
Figure P-12. SEM images of aluminum alloy 2024 sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



(a)



(b)



(c)

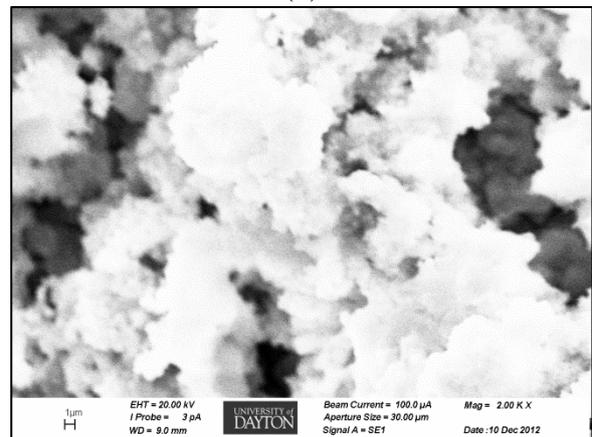
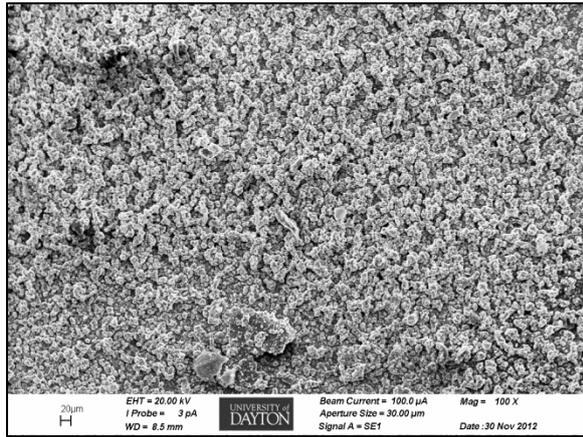
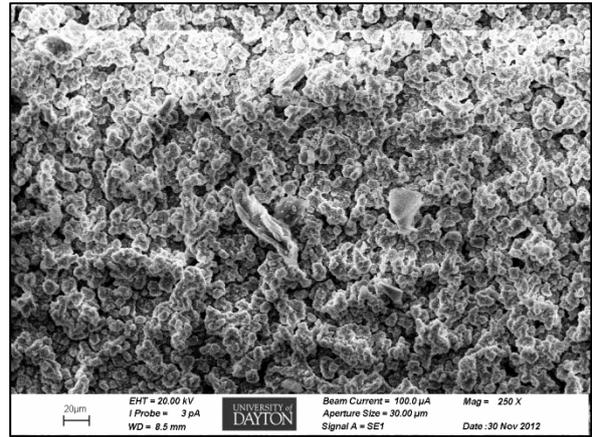


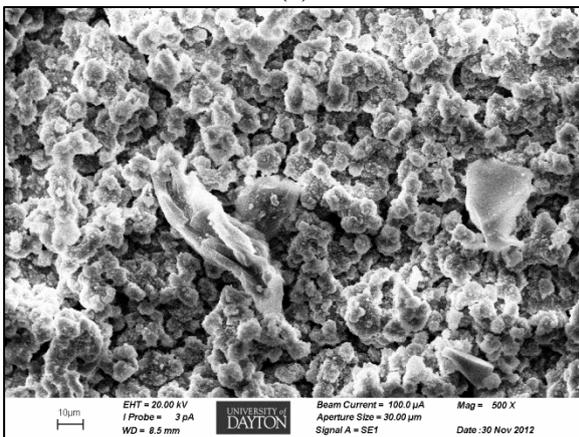
Figure P-13. SEM images of aluminum alloy 2024 sample retrieved on 900 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification



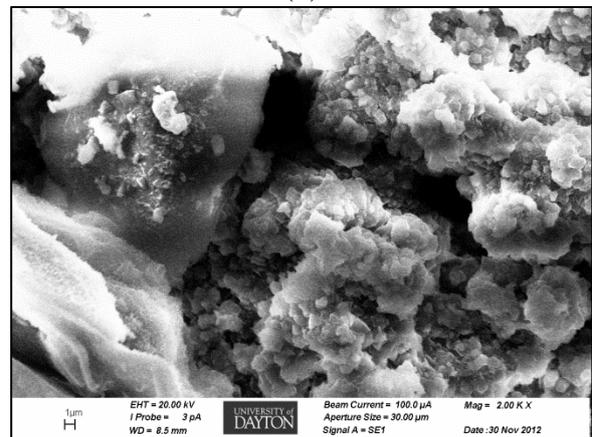
(a)



(b)

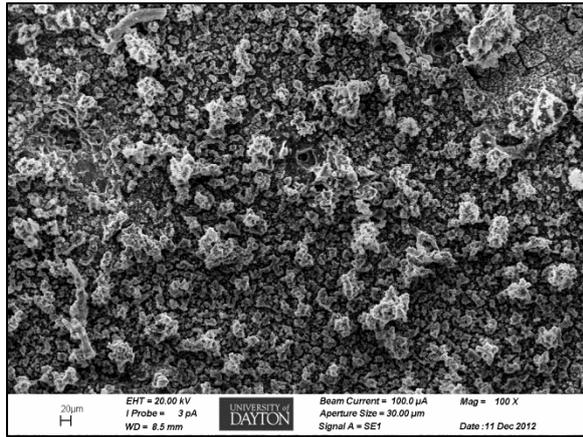


(c)

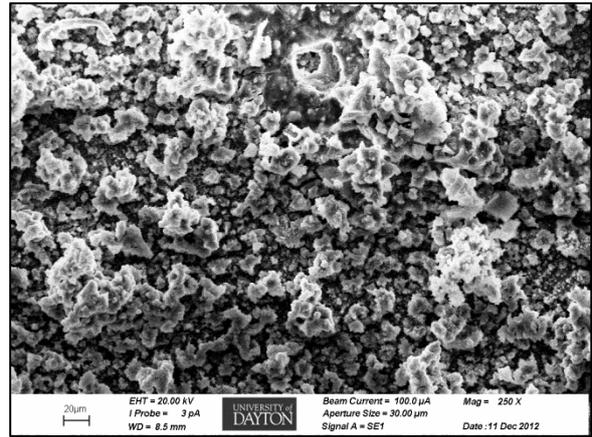


(d)

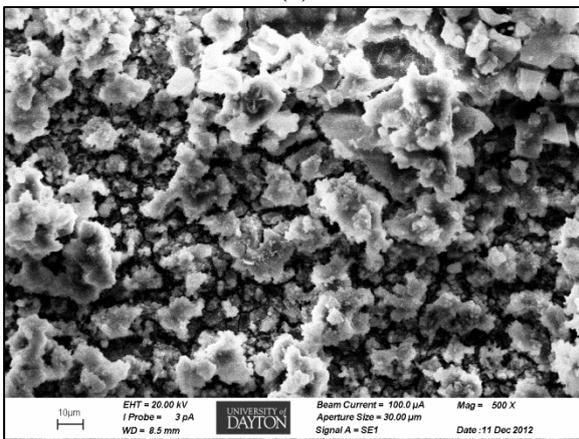
Figure P-14. SEM images of aluminum alloy 2024 sample retrieved on 800 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



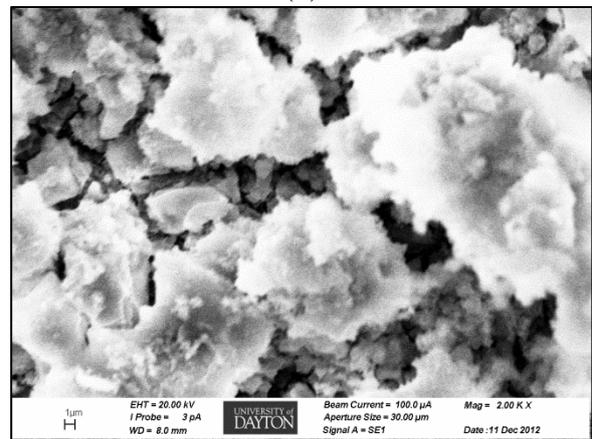
(a)



(b)

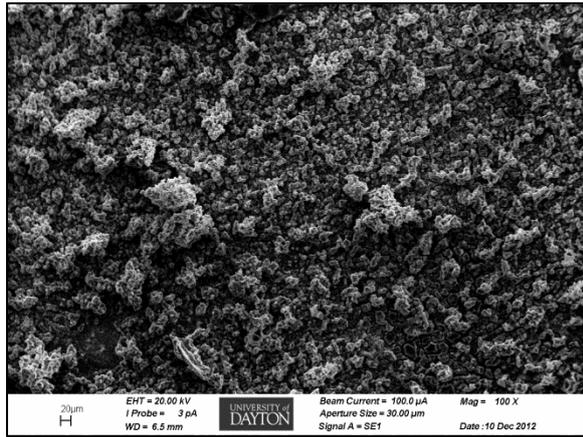


(c)

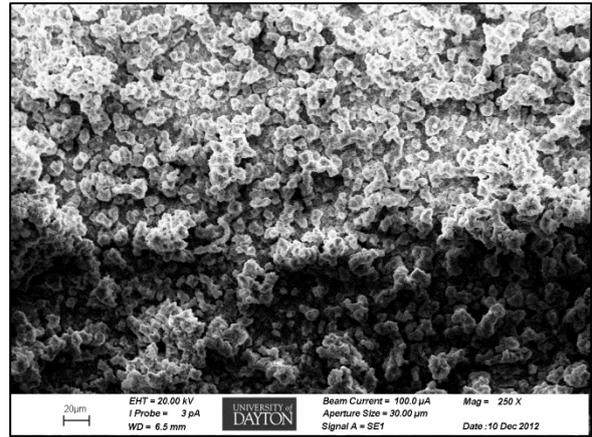


(d)

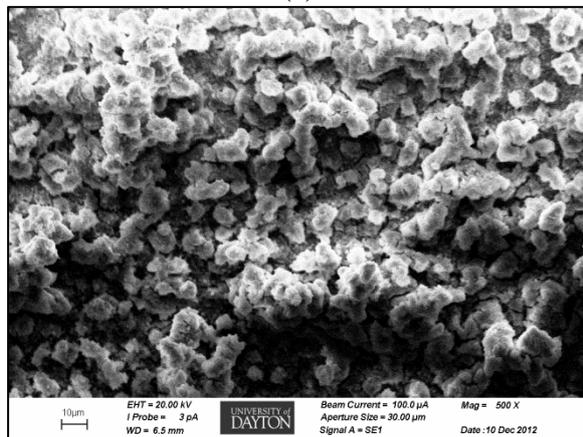
Figure P-15. SEM images of aluminum alloy 2024 sample retrieved on 700 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



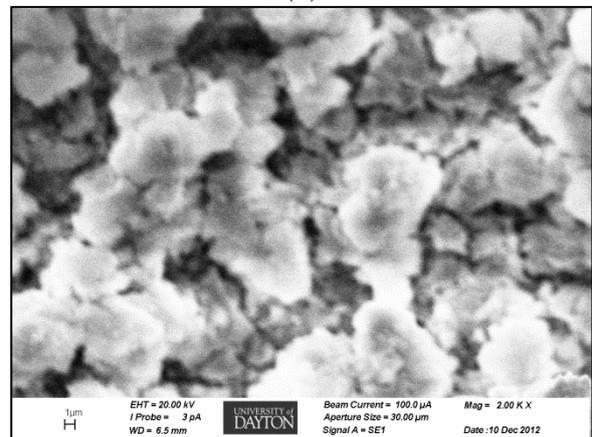
(a)



(b)

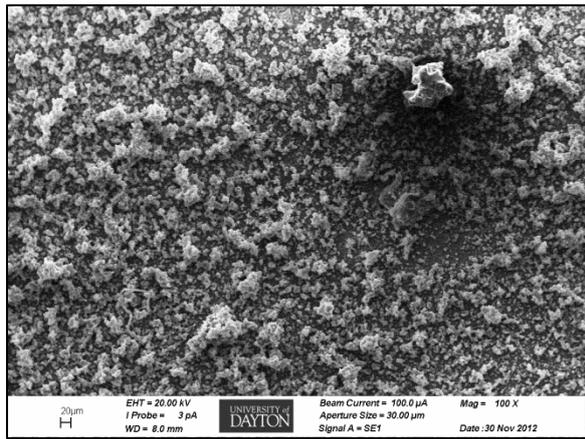


(c)

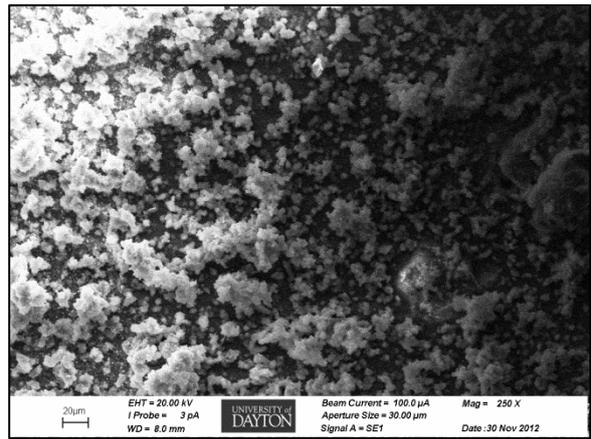


(d)

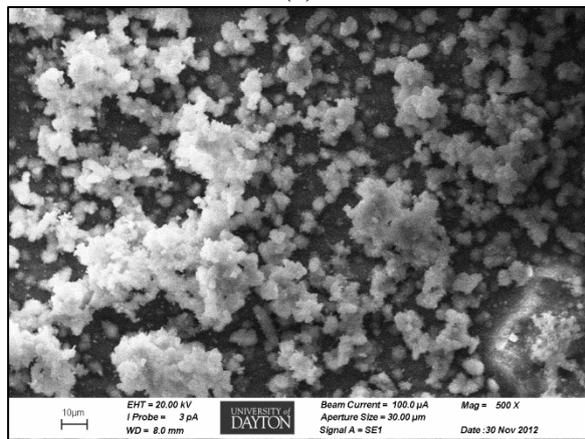
Figure P-16. SEM images of aluminum alloy 2024 sample retrieved on 600 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



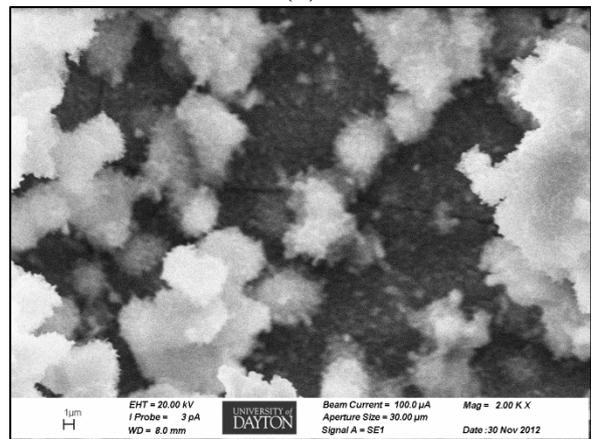
(a)



(b)

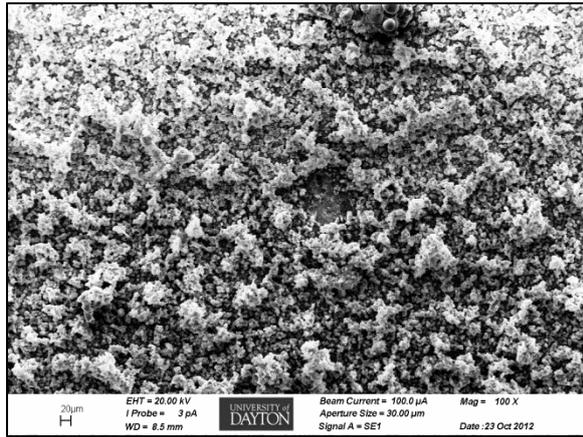


(c)

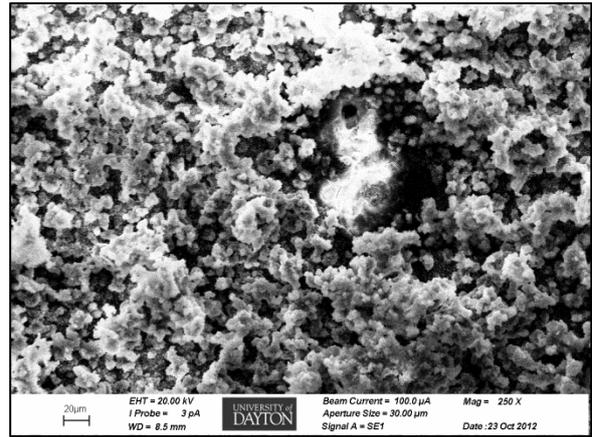


(d)

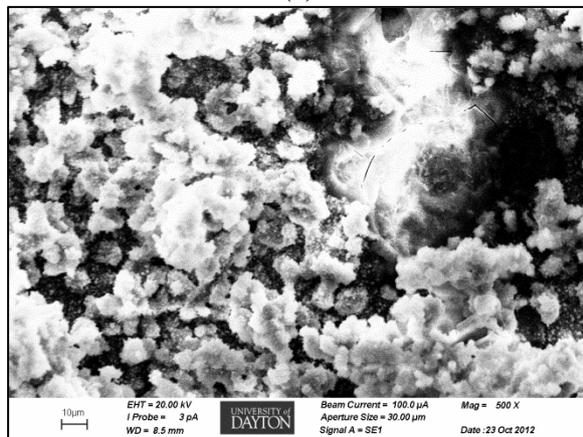
Figure P-17. SEM images of aluminum alloy 2024 sample retrieved on 500 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



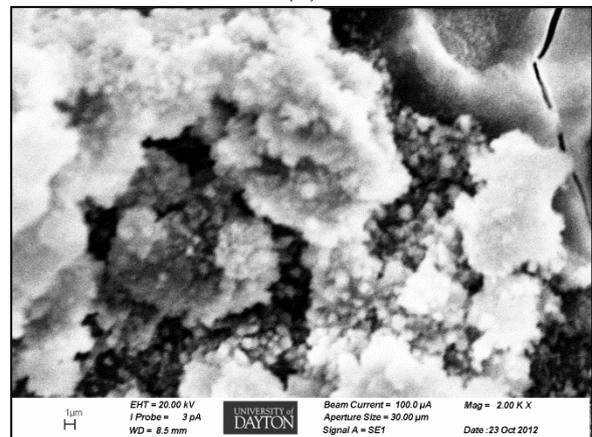
(a)



(b)

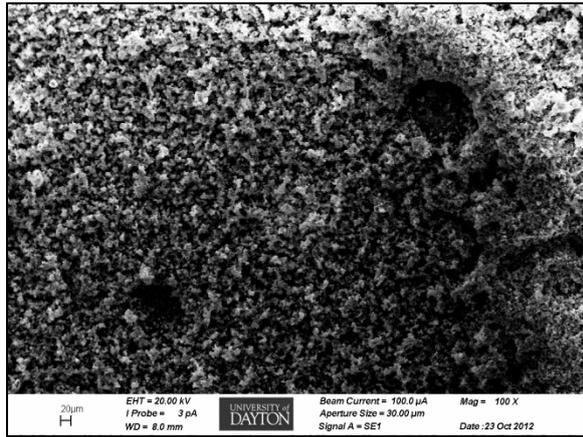


(c)

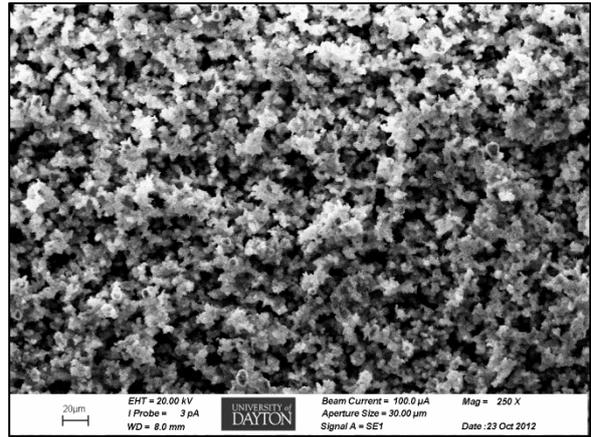


(d)

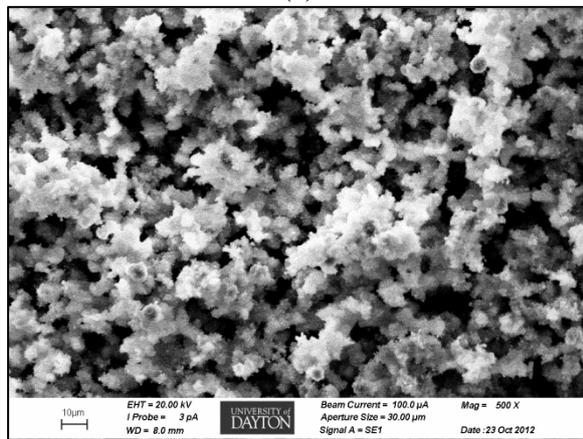
Figure P-18. SEM images of aluminum alloy 2024 sample retrieved on 400 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



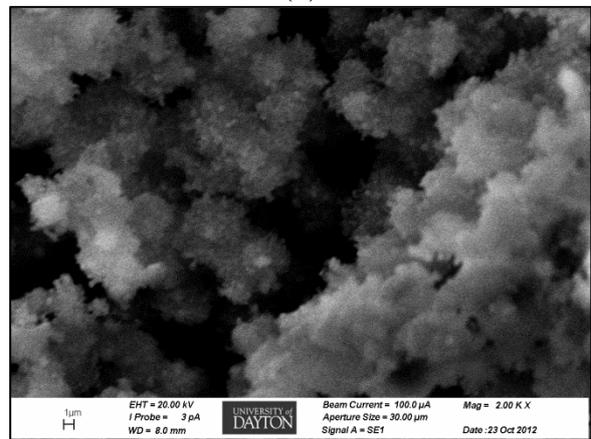
(a)



(b)

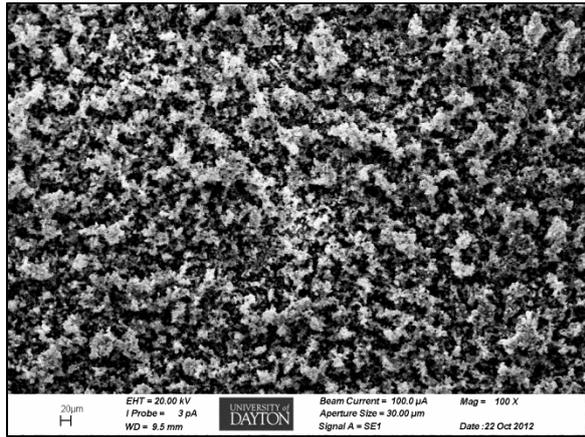


(c)

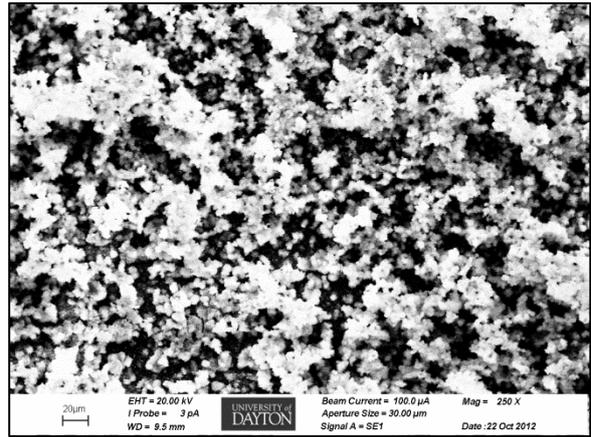


(d)

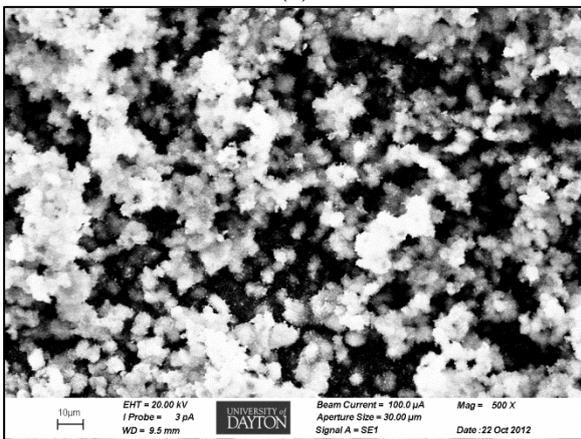
Figure P-19. SEM images of aluminum alloy 2024 sample retrieved on 300 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification, (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



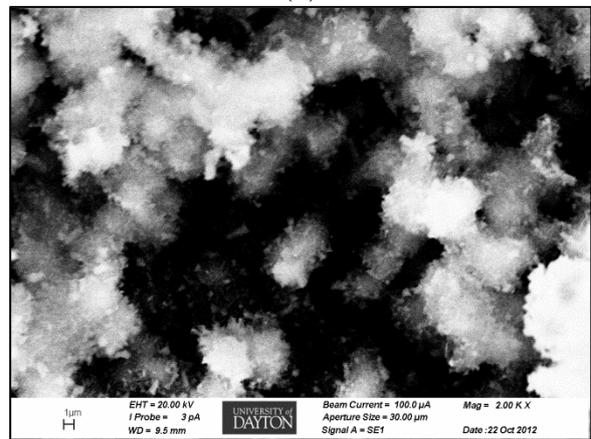
(a)



(b)

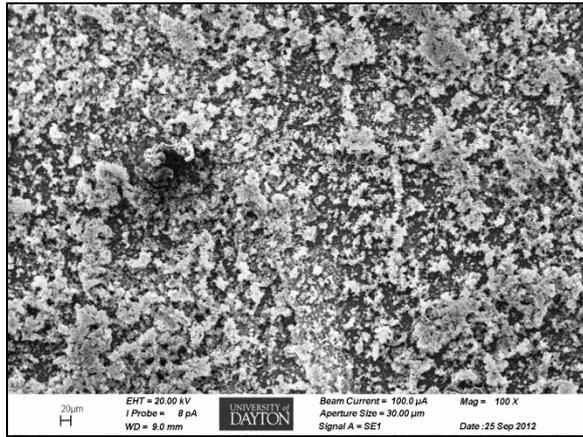


(c)

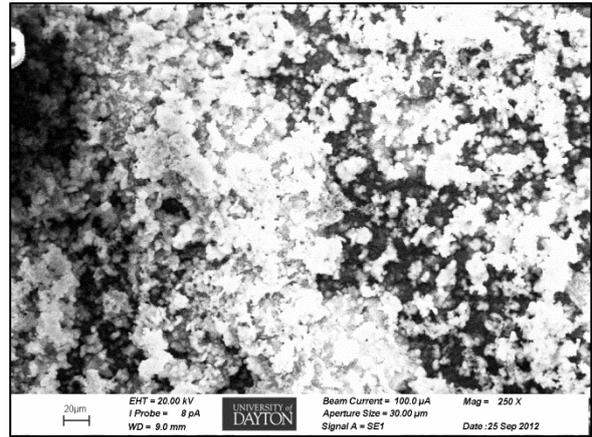


(d)

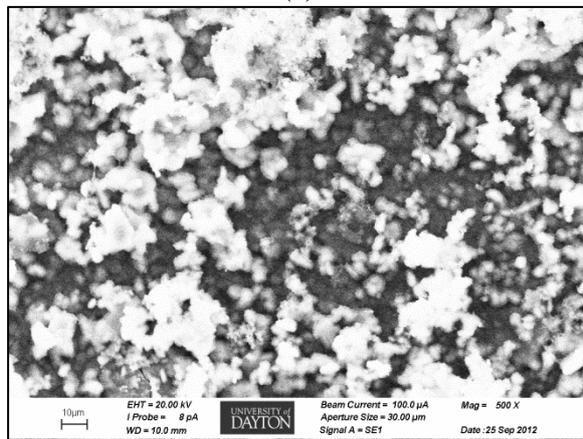
Figure P-20. SEM images of aluminum alloy 2024 sample retrieved on 200 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



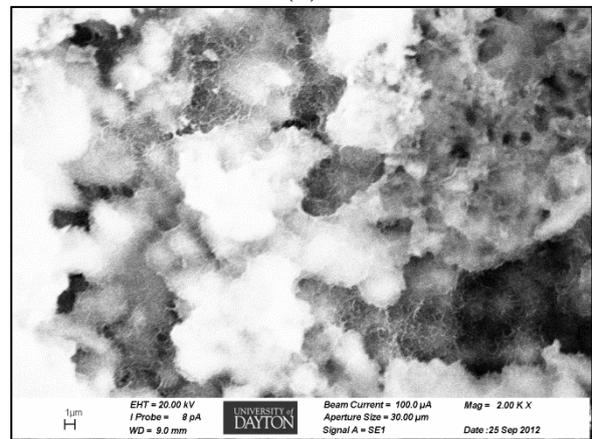
(a)



(b)

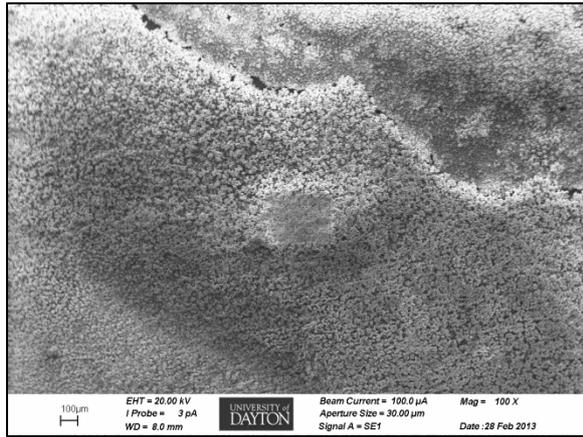


(c)

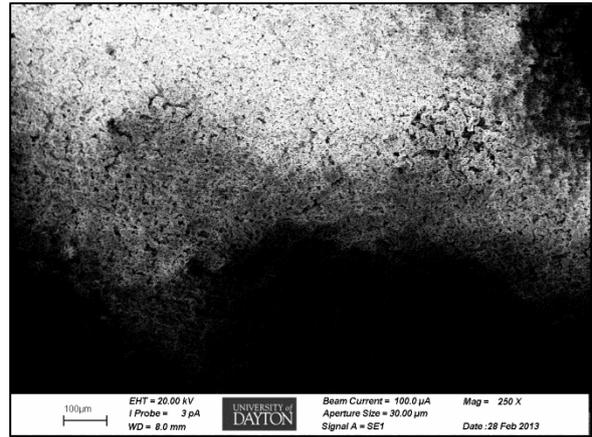


(d)

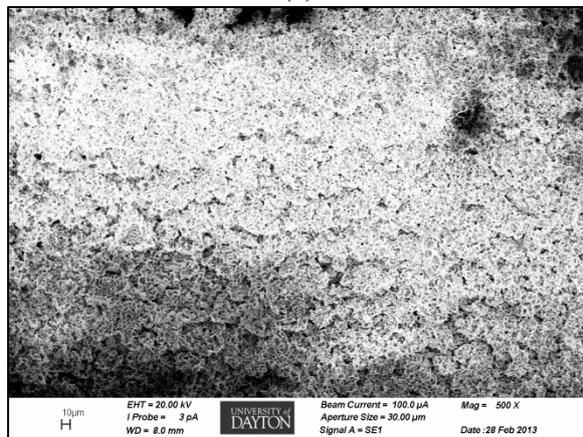
Figure P-21. SEM images of aluminum alloy 2024 sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification, (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



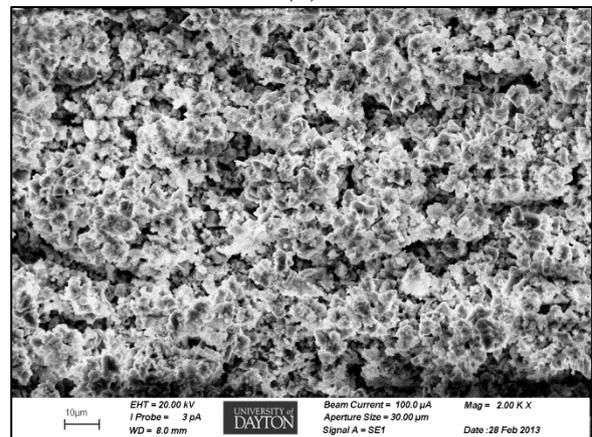
(a)



(b)

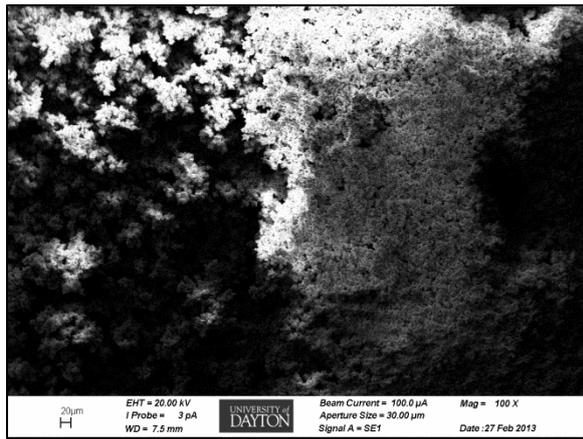


(c)

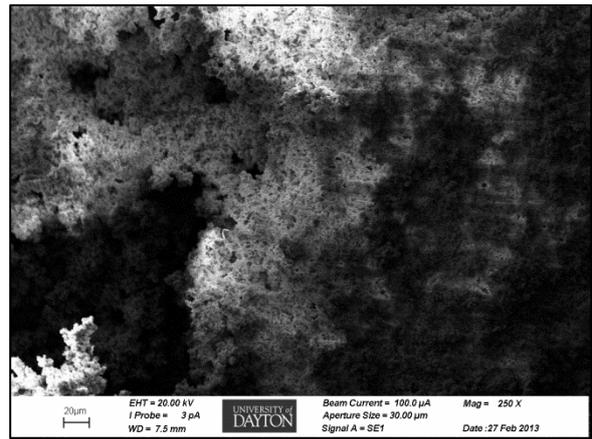


(d)

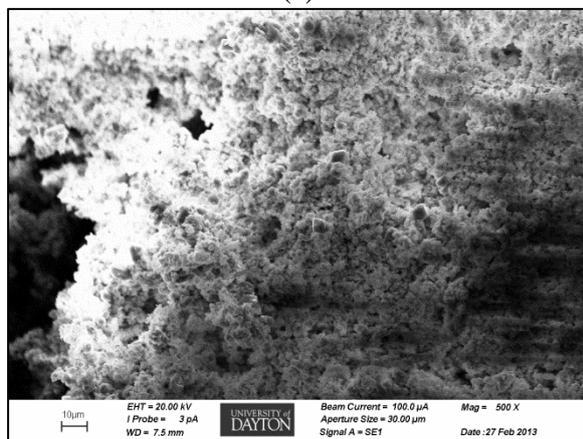
Figure P-22. SEM images of pure copper sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



(a)

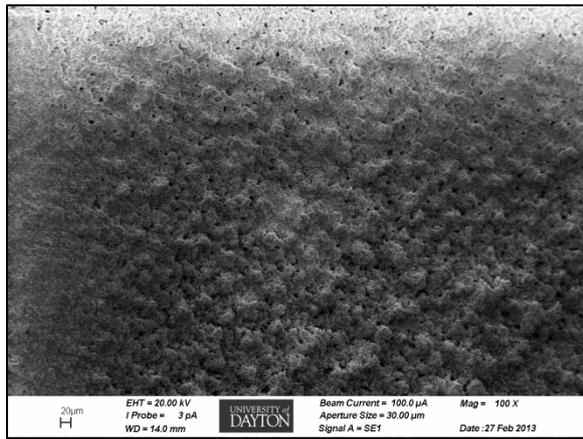


(b)

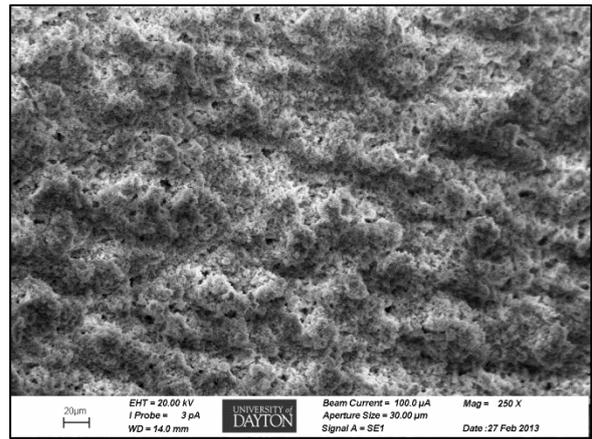


(c)

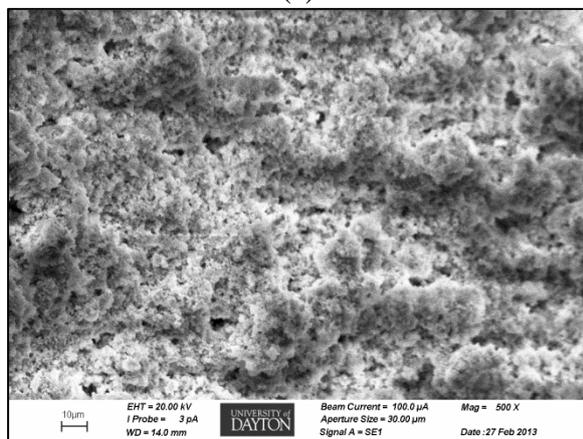
Figure P-23. SEM images of pure copper sample retrieved on 900 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, and (c) 500X magnification.



(a)



(b)

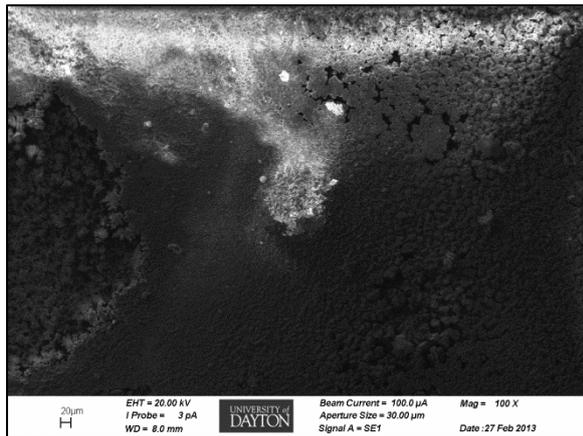


(c)

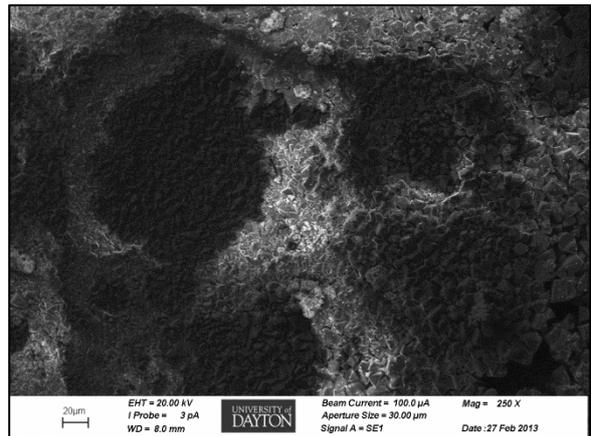


(d)

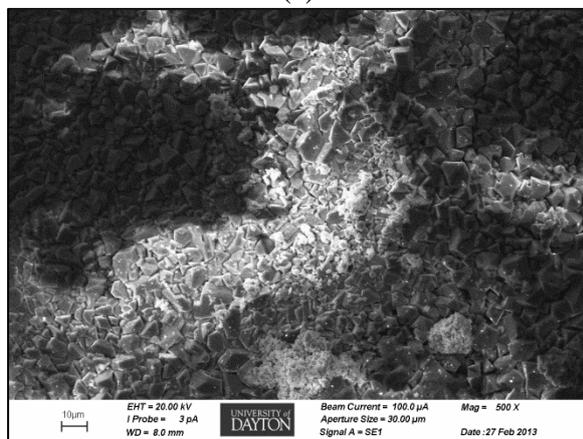
Figure P-24. SEM images of pure copper sample retrieved on 800 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



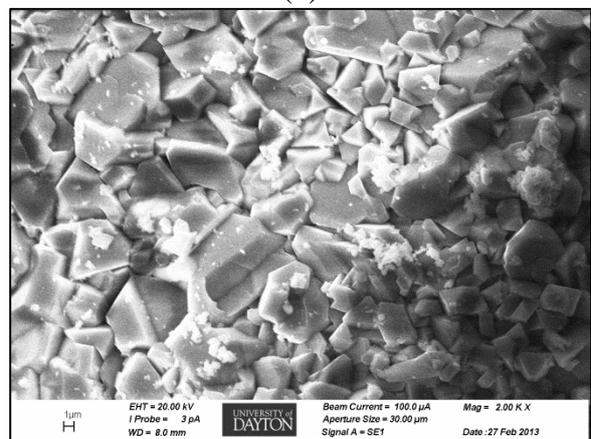
(a)



(b)

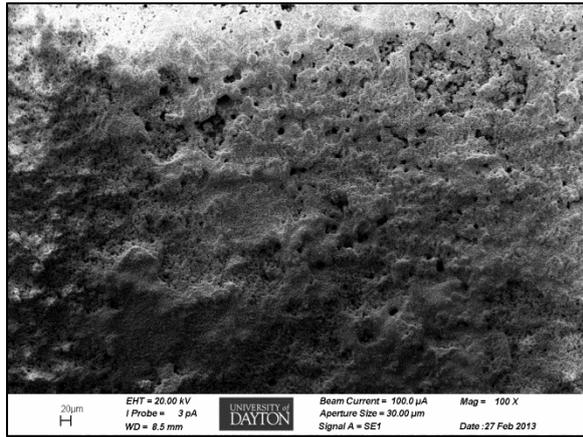


(c)

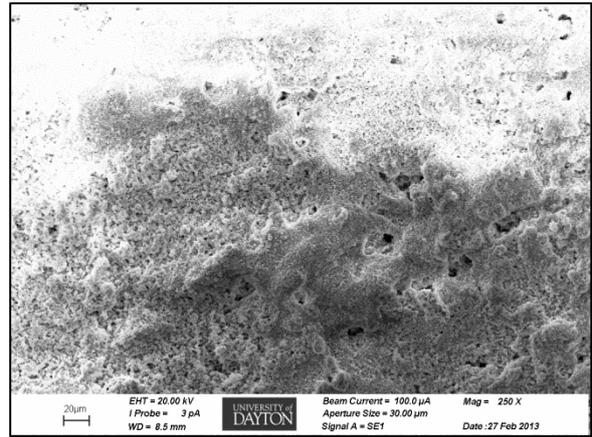


(d)

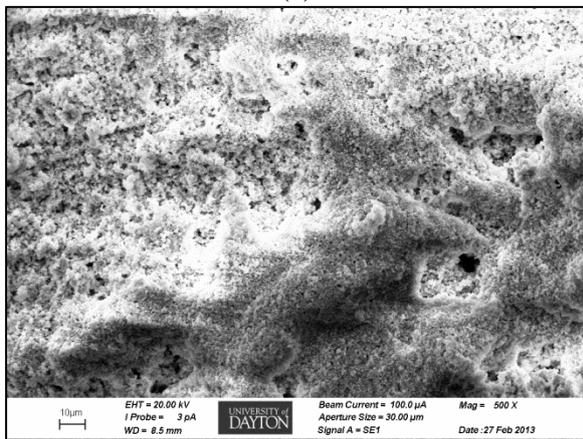
Figure P-25. SEM images of pure copper sample retrieved on 700 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



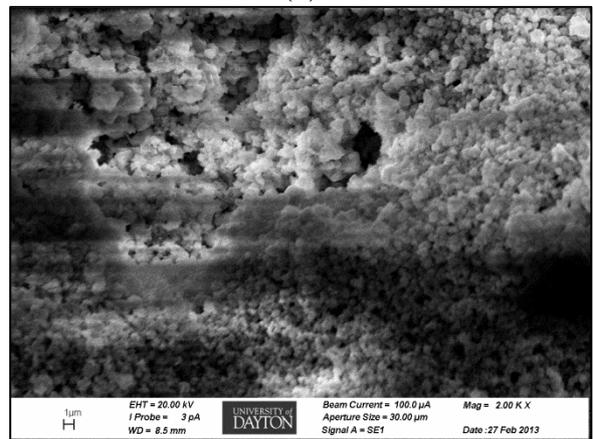
(a)



(b)

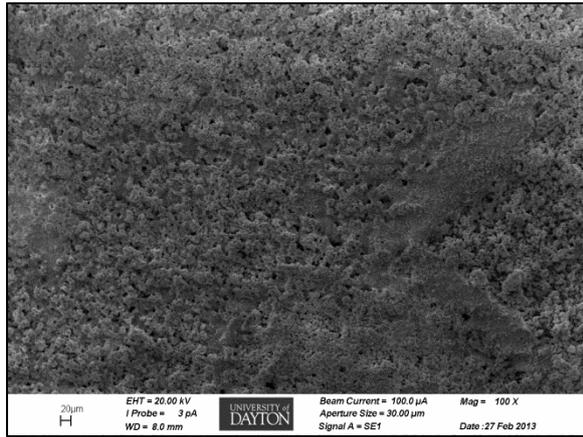


(c)

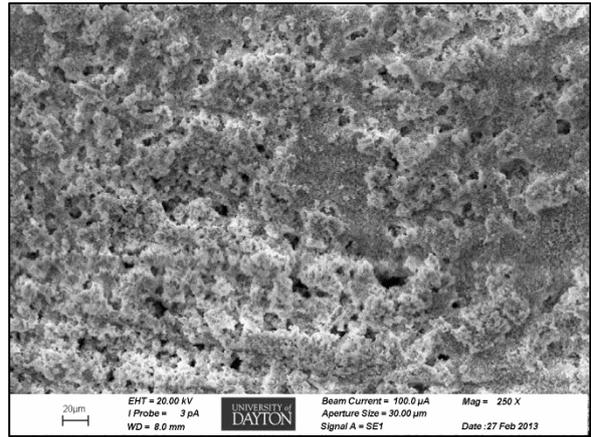


(d)

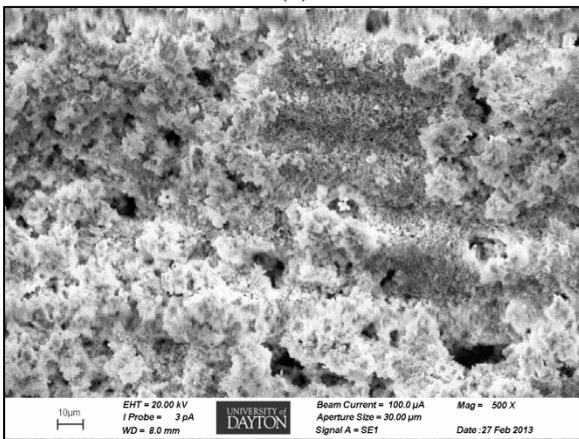
Figure P-26. SEM images of pure copper sample retrieved on 600 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



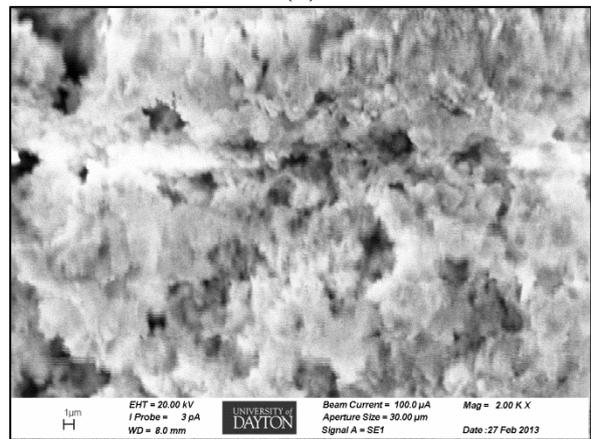
(a)



(b)

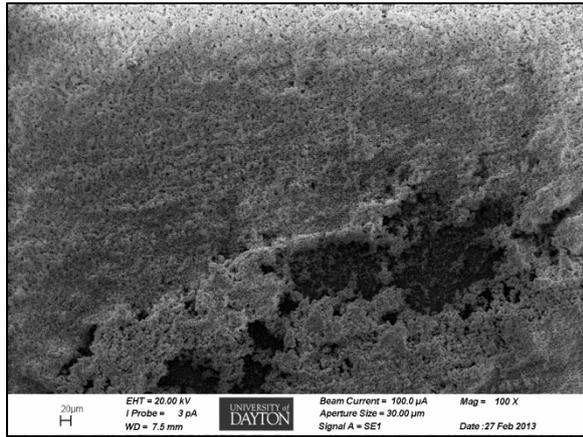


(c)

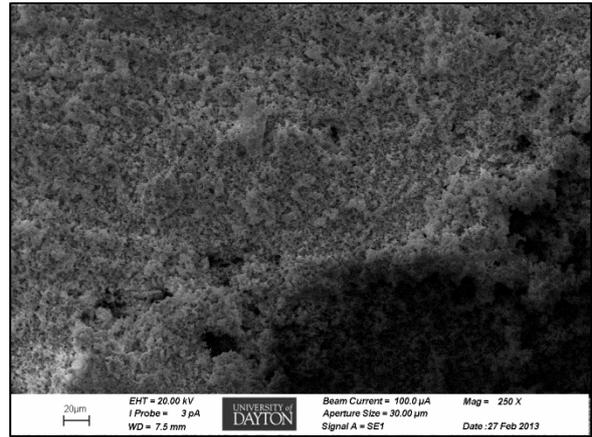


(d)

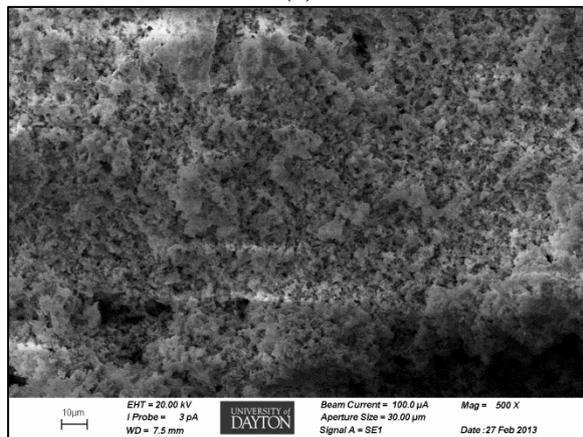
Figure P-27. SEM images of pure copper sample retrieved on 500 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



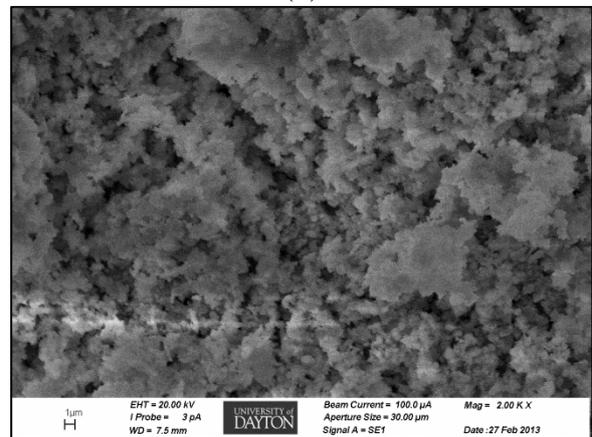
(a)



(b)

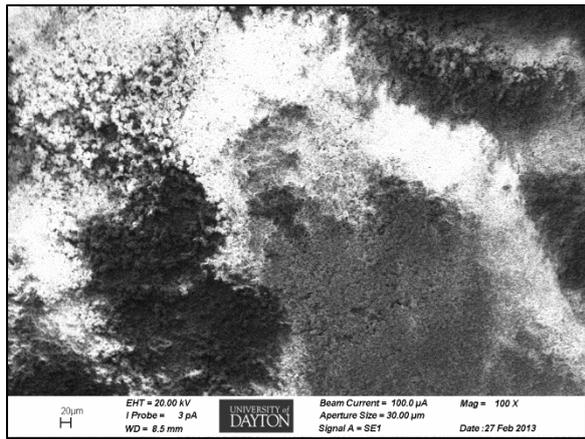


(c)

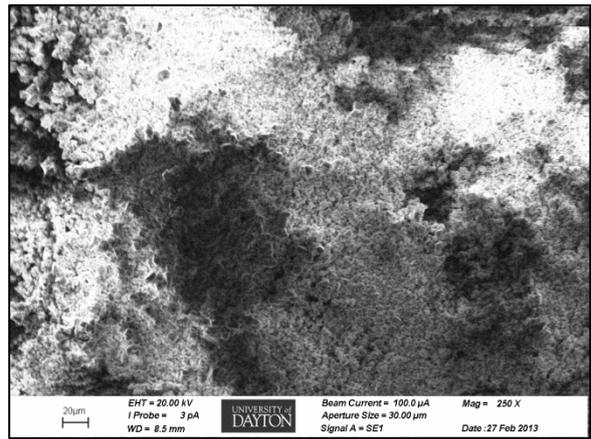


(d)

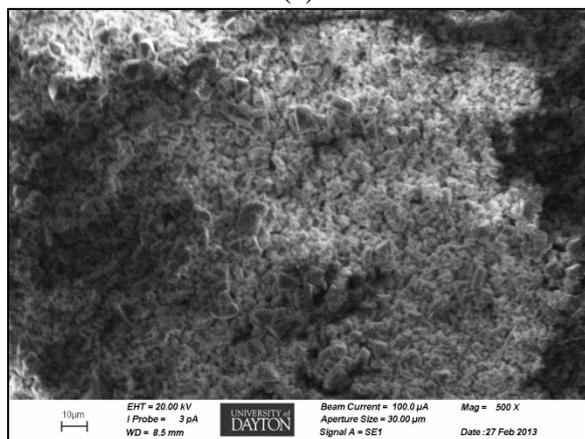
Figure P-28. SEM images of pure copper sample retrieved on 400 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification., and (d) 2000X magnification.



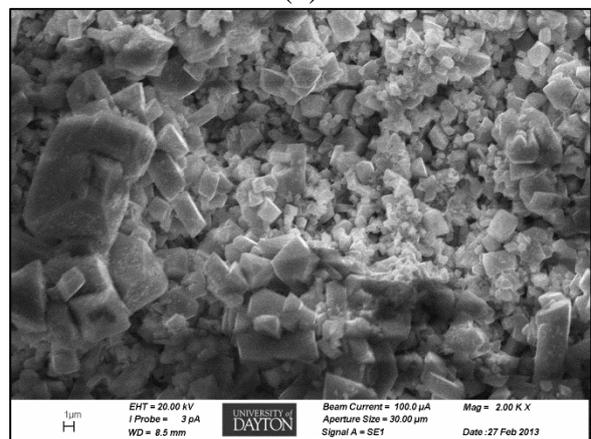
(a)



(b)

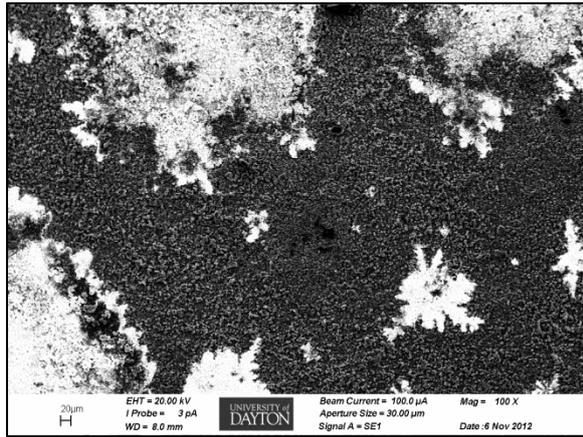


(c)

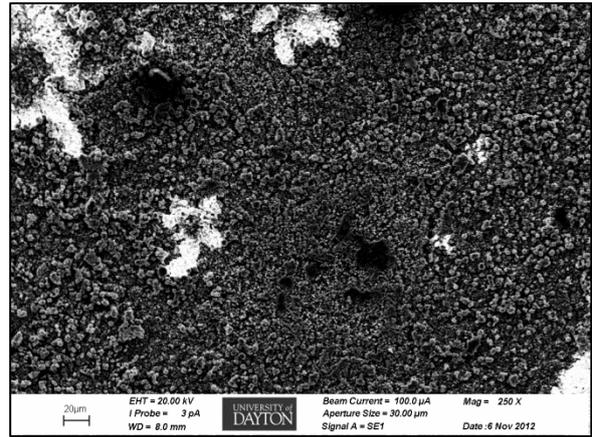


(d)

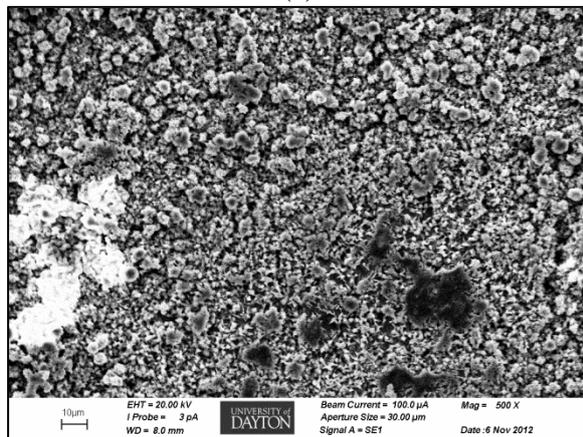
Figure P-29. SEM images of pure copper sample retrieved on 300 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



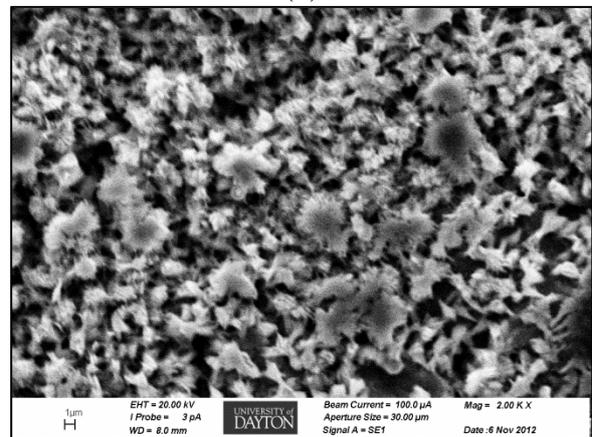
(a)



(b)

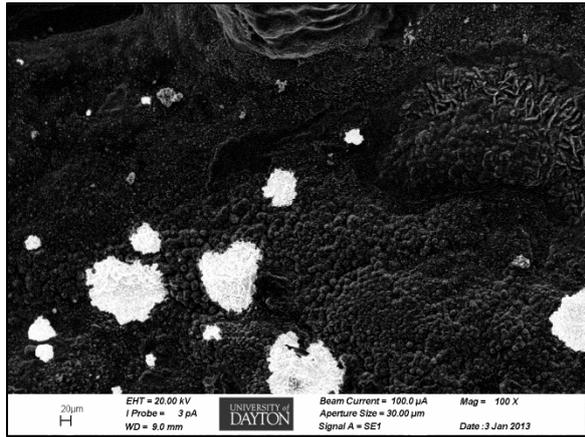


(c)

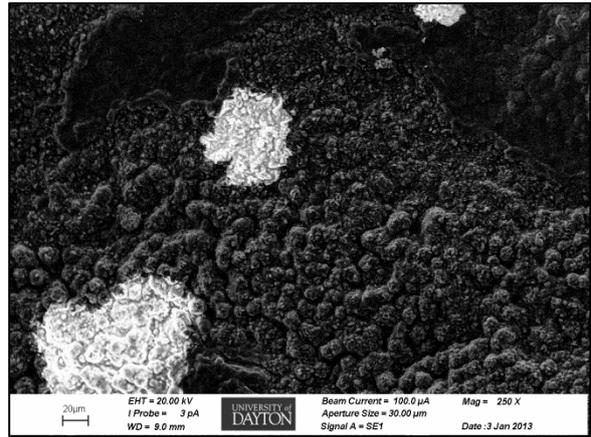


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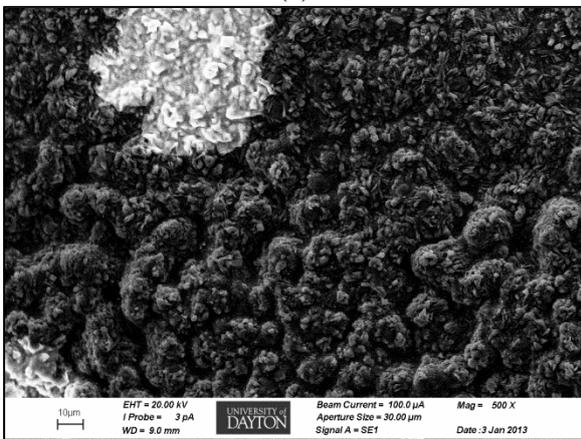
Figure P-30. SEM images of pure copper sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



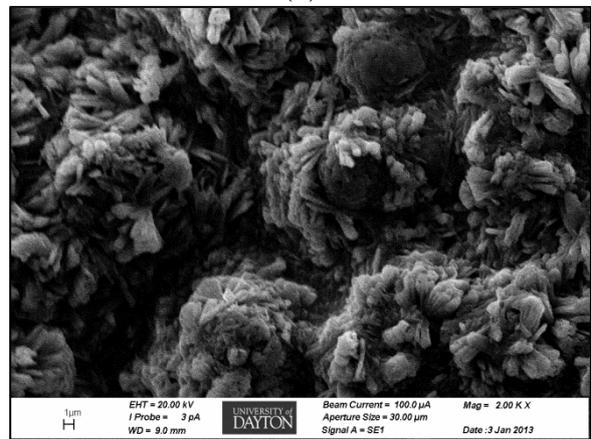
(a)



(b)

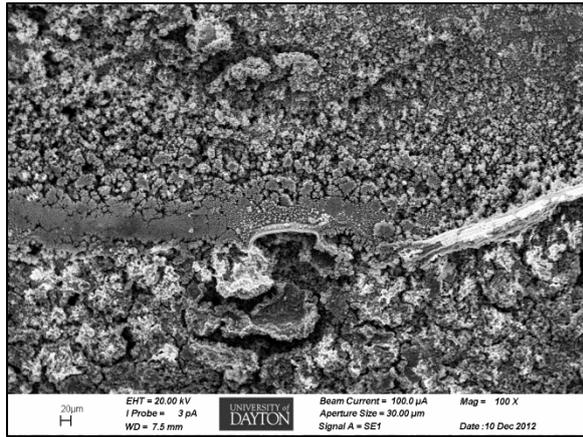


(c)

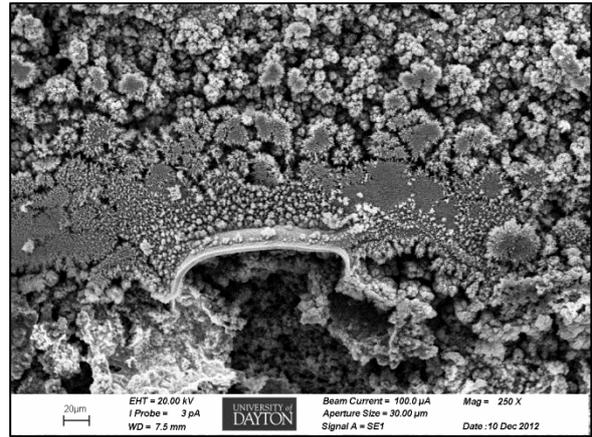


(d)

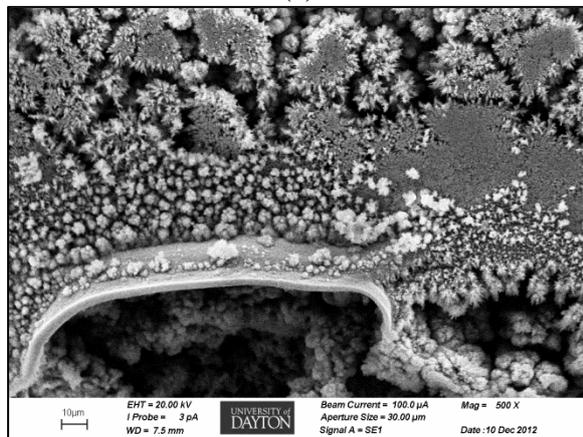
Figure P-31. SEM images of 1010 steel sample retrieved on 1000 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 500X magnification.



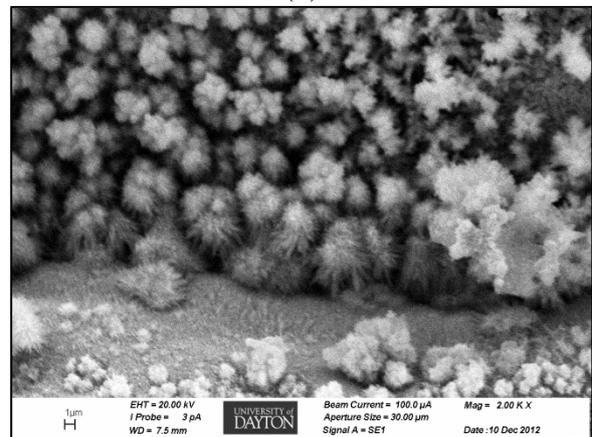
(a)



(b)

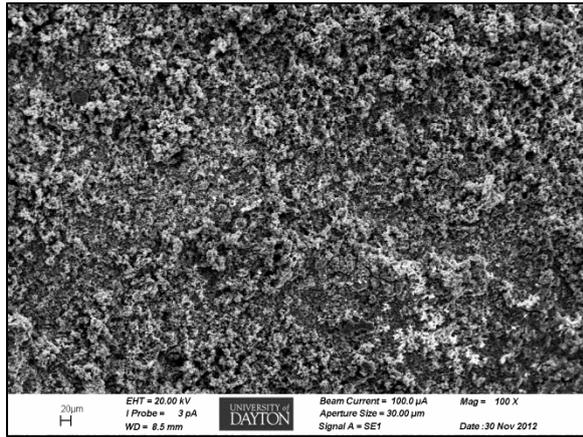


(c)

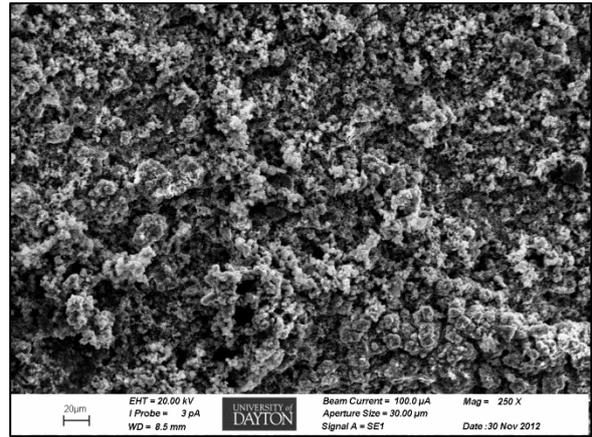


(d)

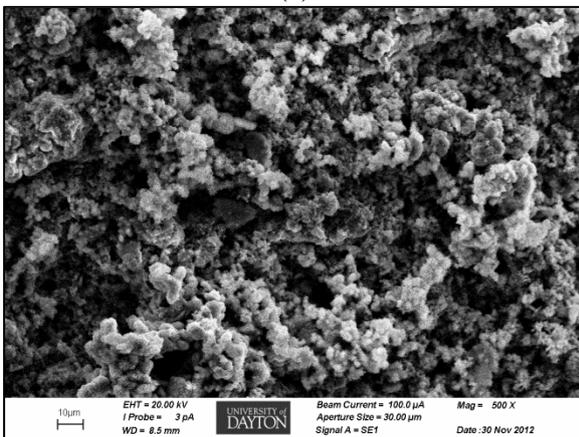
Figure P-32. SEM images of 1010 steel sample retrieved on 900 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



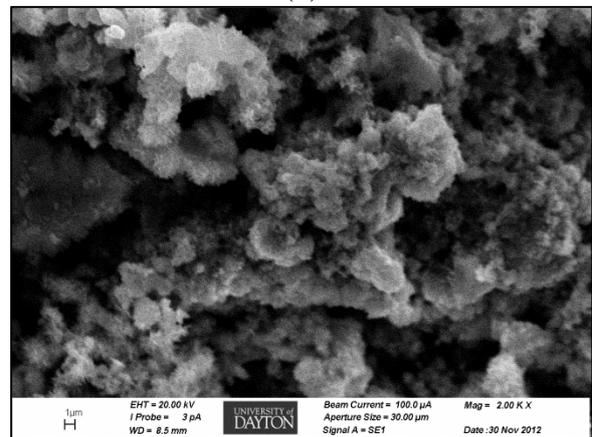
(a)



(b)

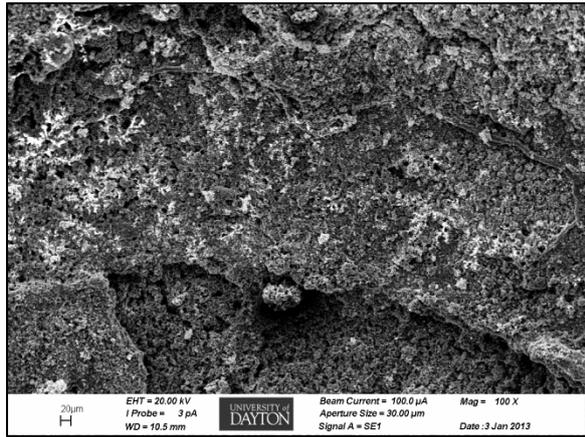


(c)

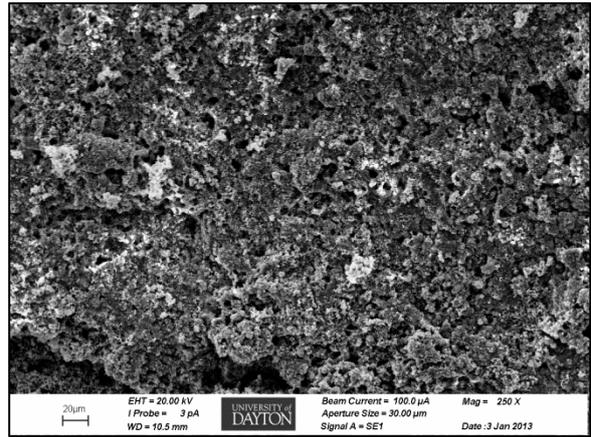


(d)

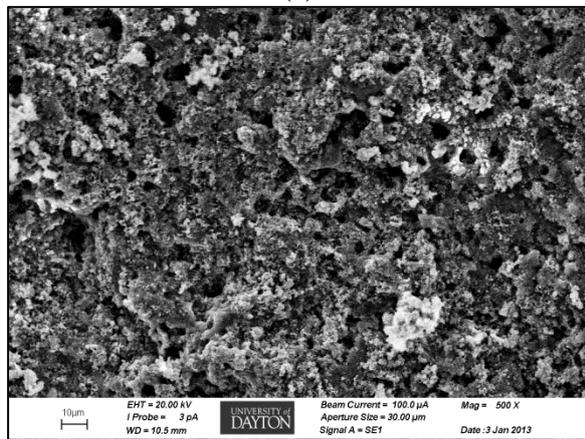
Figure P-33. SEM images of 1010 steel sample retrieved on 800 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



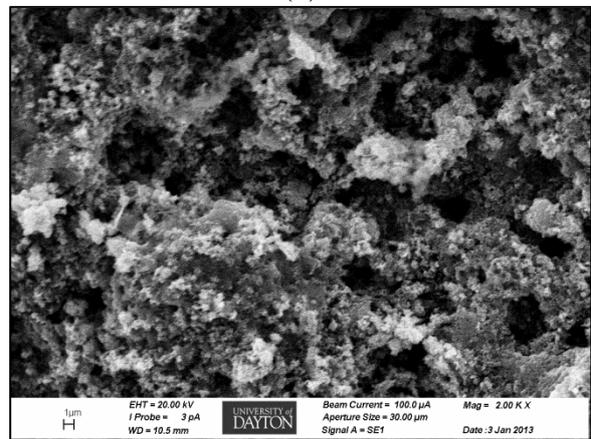
(a)



(b)

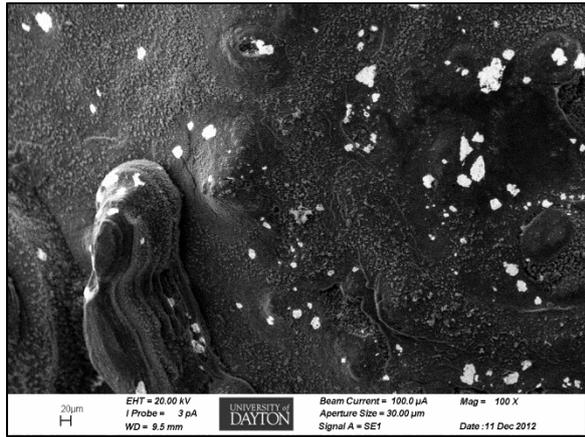


(c)

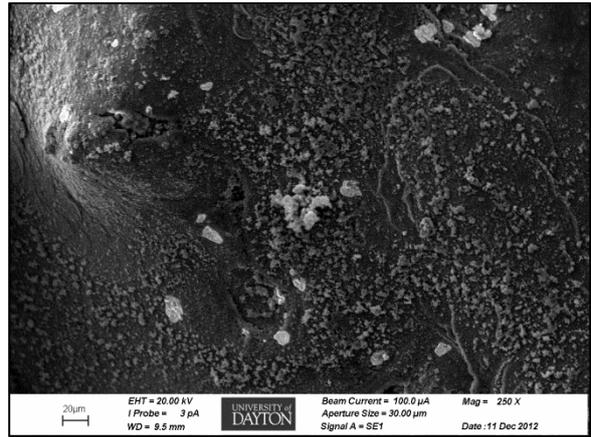


(d)

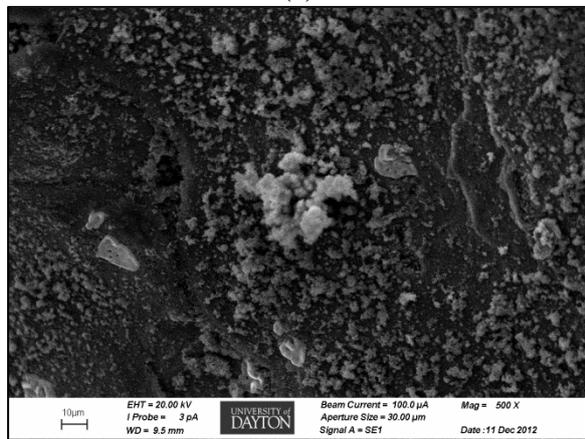
Figure P-34. SEM images of 1010 steel sample retrieved on 700 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



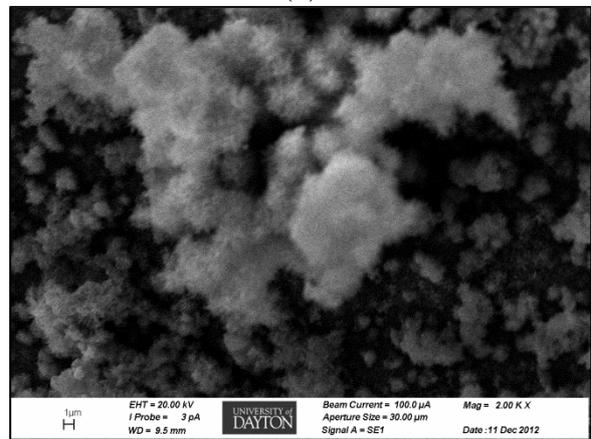
(a)



(b)

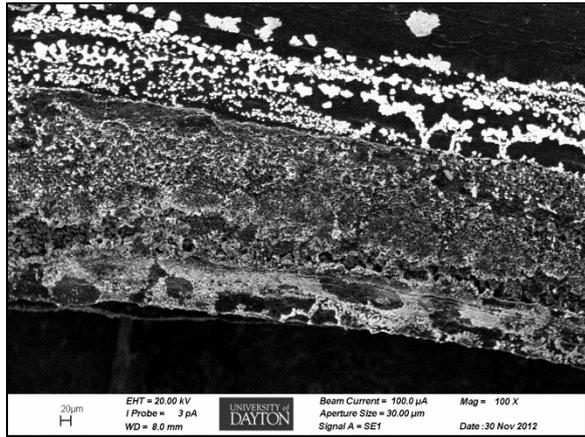


(c)

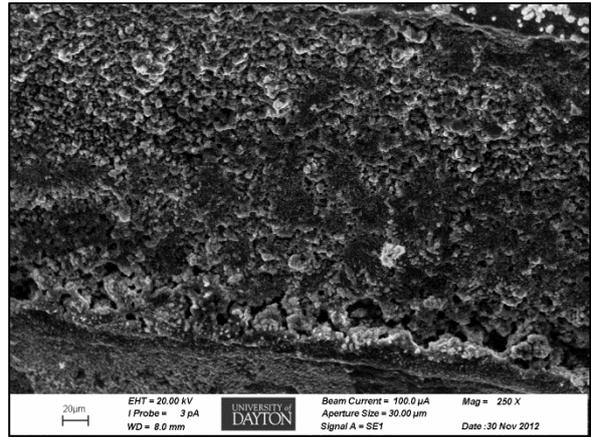


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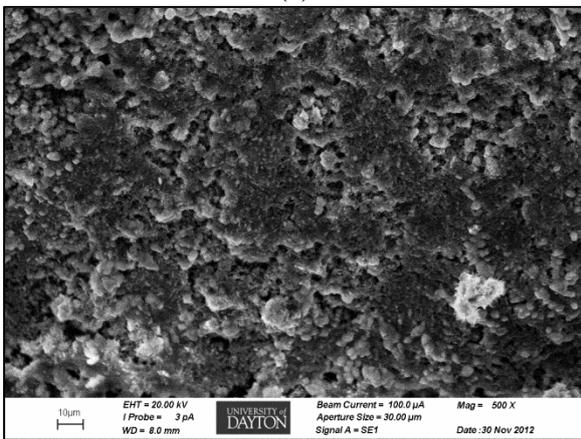
Figure P-35. SEM images of 1010 steel sample retrieved on 600 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



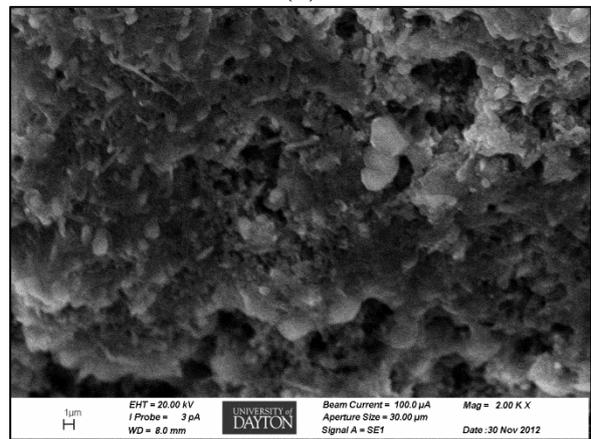
(a)



(b)

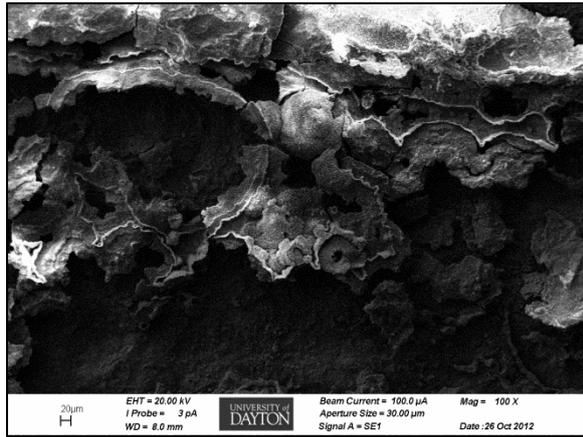


(c)

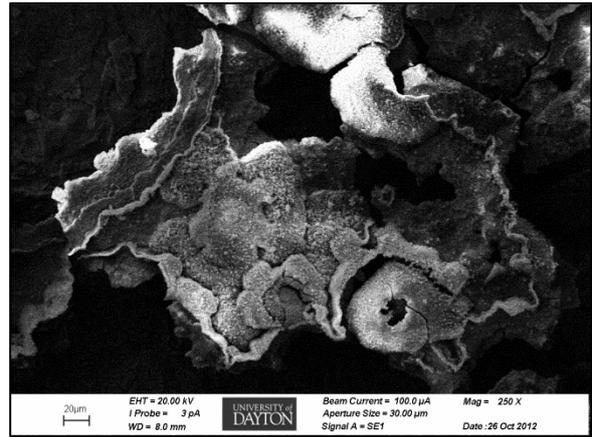


(d)

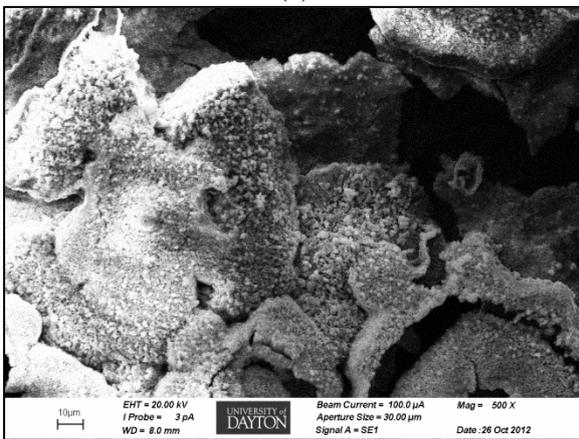
Figure P-36. SEM images of 1010 steel sample retrieved on 500 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



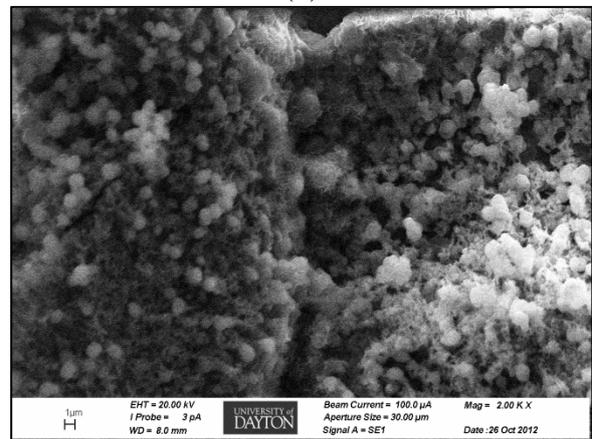
(a)



(b)

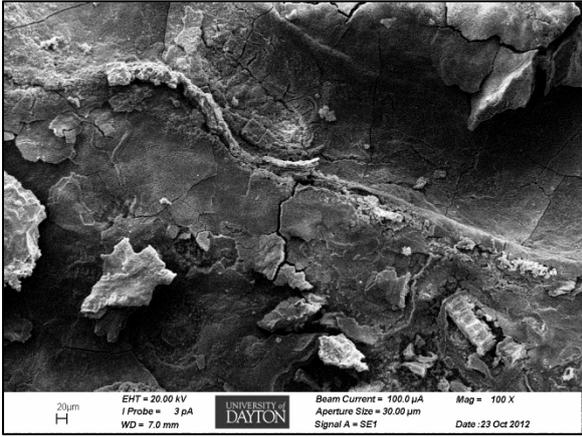


(c)

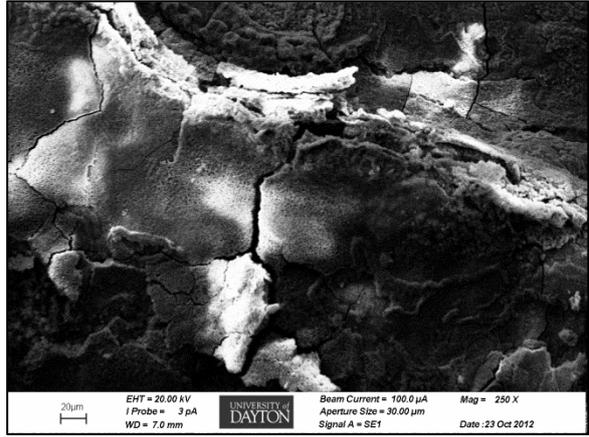


(d)

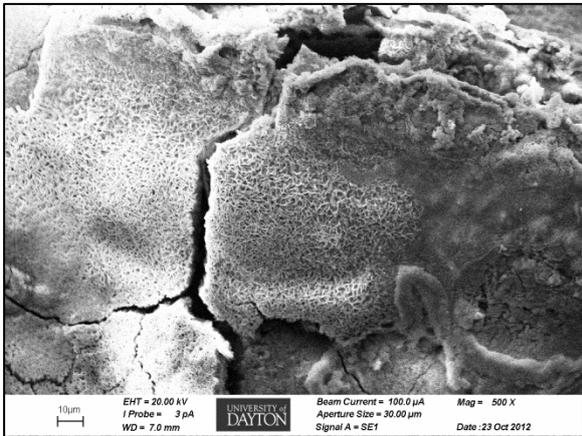
Figure P-37. SEM images of 1010 steel sample retrieved on 400 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



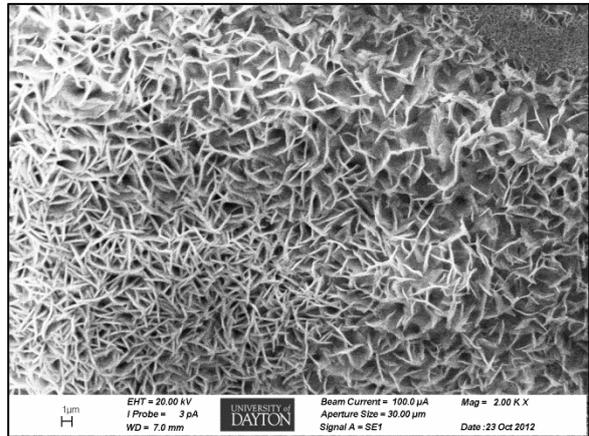
(a)



(b)

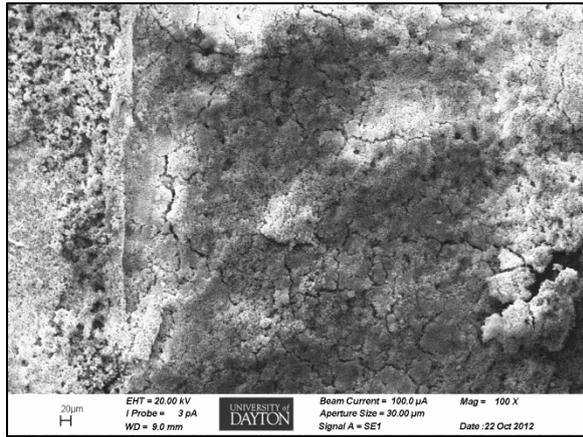


(c)

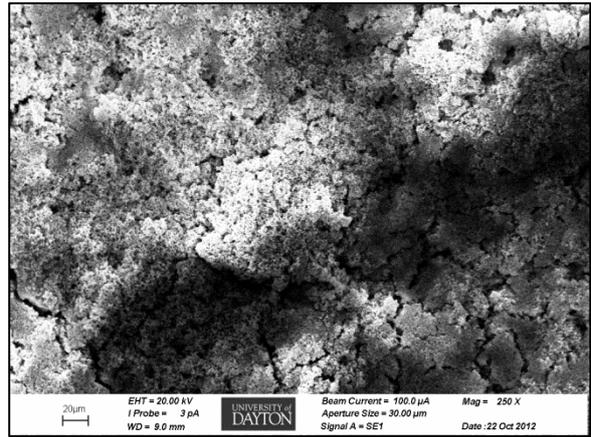


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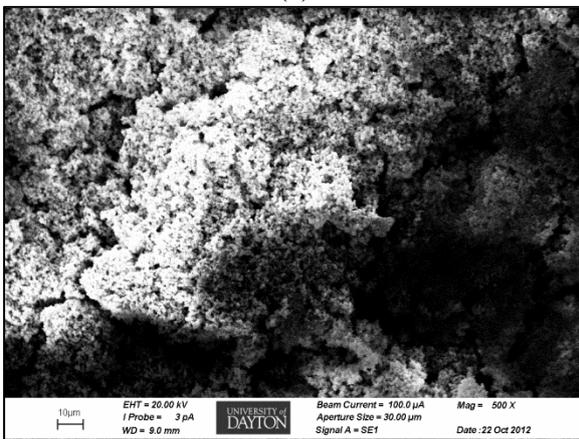
Figure P-38. SEM images of 1010 steel sample retrieved on 300 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification, (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



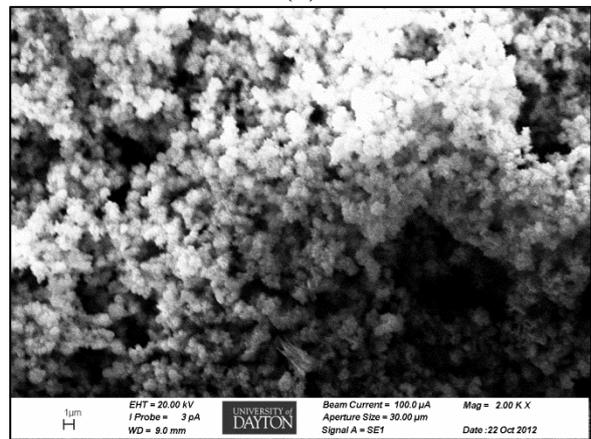
(a)



(b)

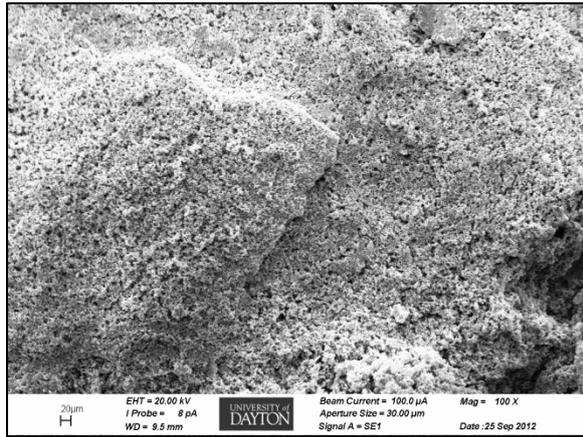


(c)

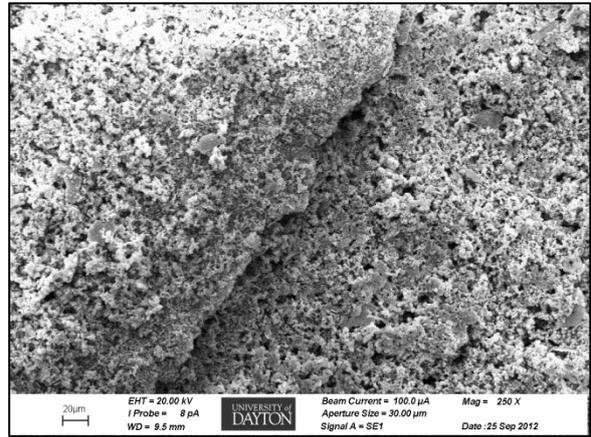


(d)

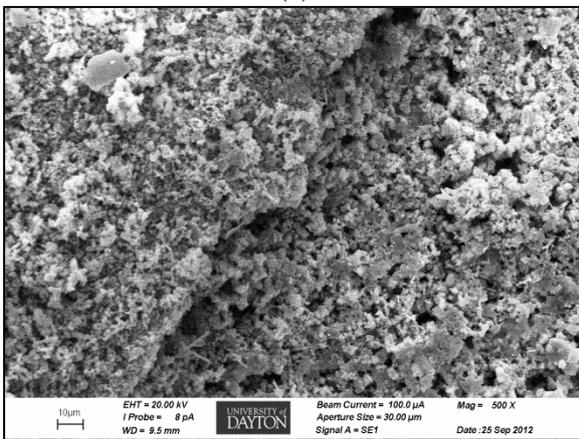
Figure P-39. SEM images of 1010 steel sample retrieved on 200 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification (b) 250X magnification, (c) 500X magnification, and (d) 2000X magnification.



(a)



(b)



(c)

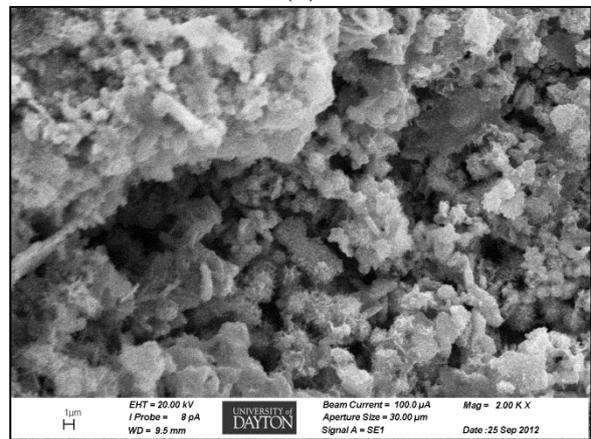


Figure P-40. SEM images of 1010 steel sample retrieved on 100 hours exposure from Low UV (0.1 W/cm<sup>2</sup>) and high Ozone (800 ppb) chamber. (a) 100X magnification, (b) 250X magnification, and (c) 500X magnification..

# **Appendix Q**

**EDS Data for All Chamber Exposures**

**(Modified and B117)**

**Bare Metal Coupons**

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Figure Q - 29. EDS of pure copper samples retrieved from ASTM B117 chamber ..... 33

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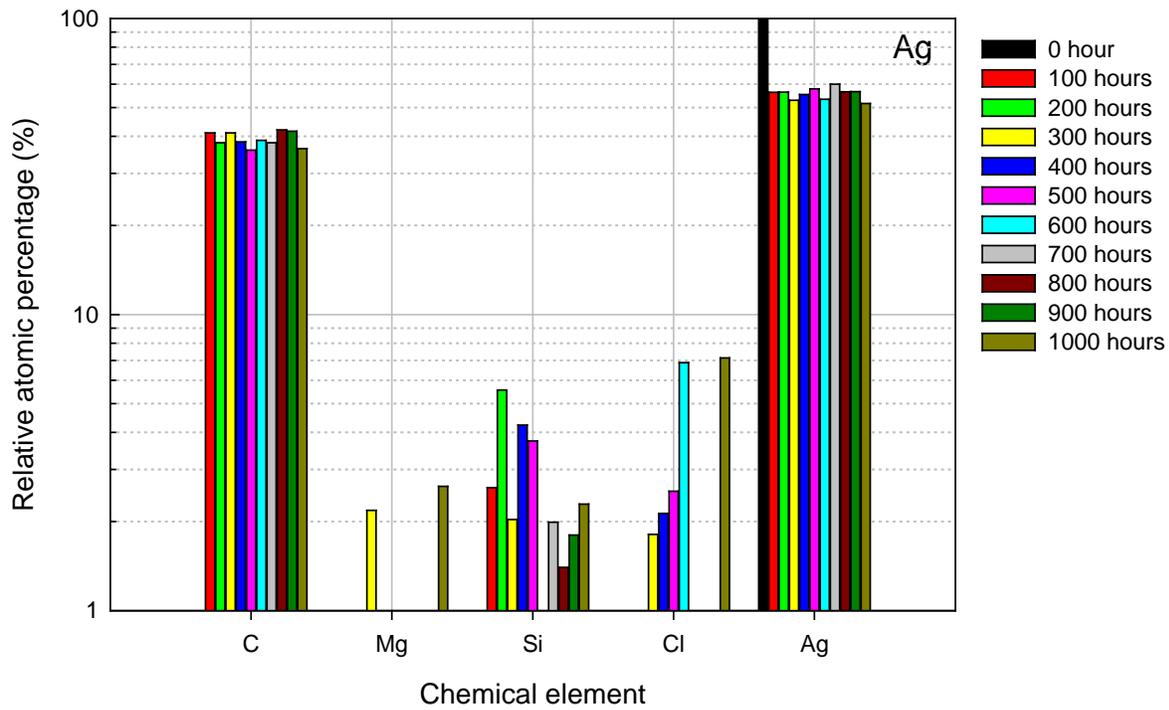


Figure Q - 1. EDS of pure silver samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

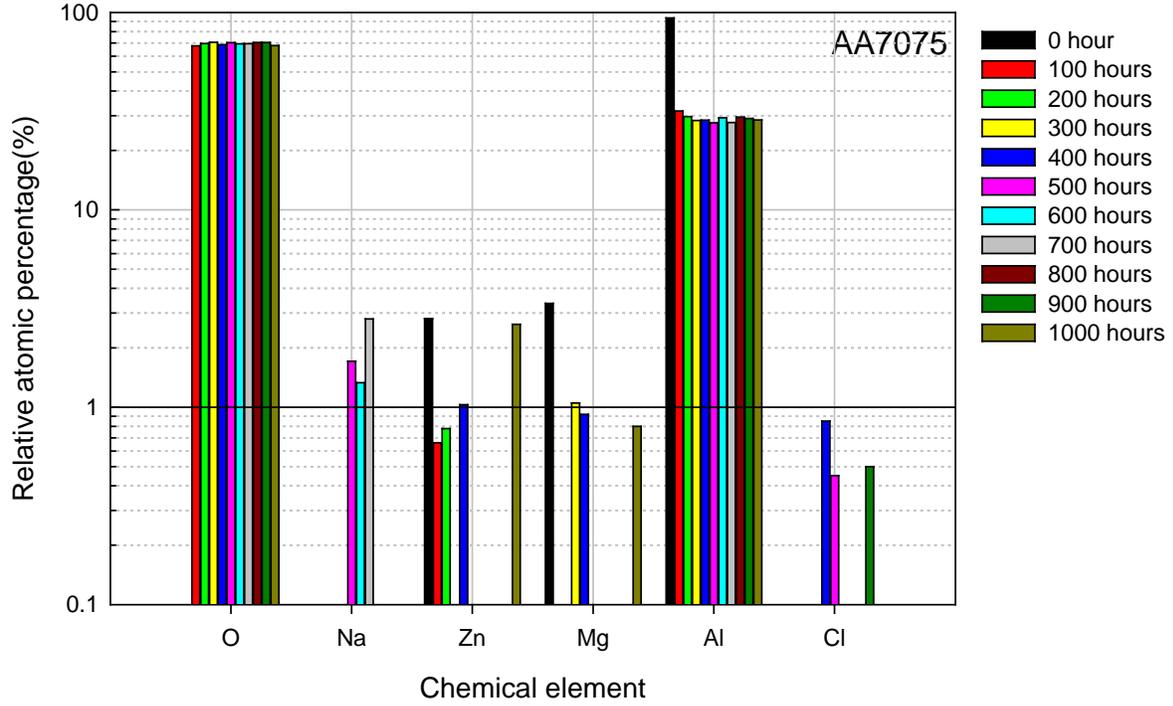


Figure Q - 2. EDS of aluminum alloy 7075 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

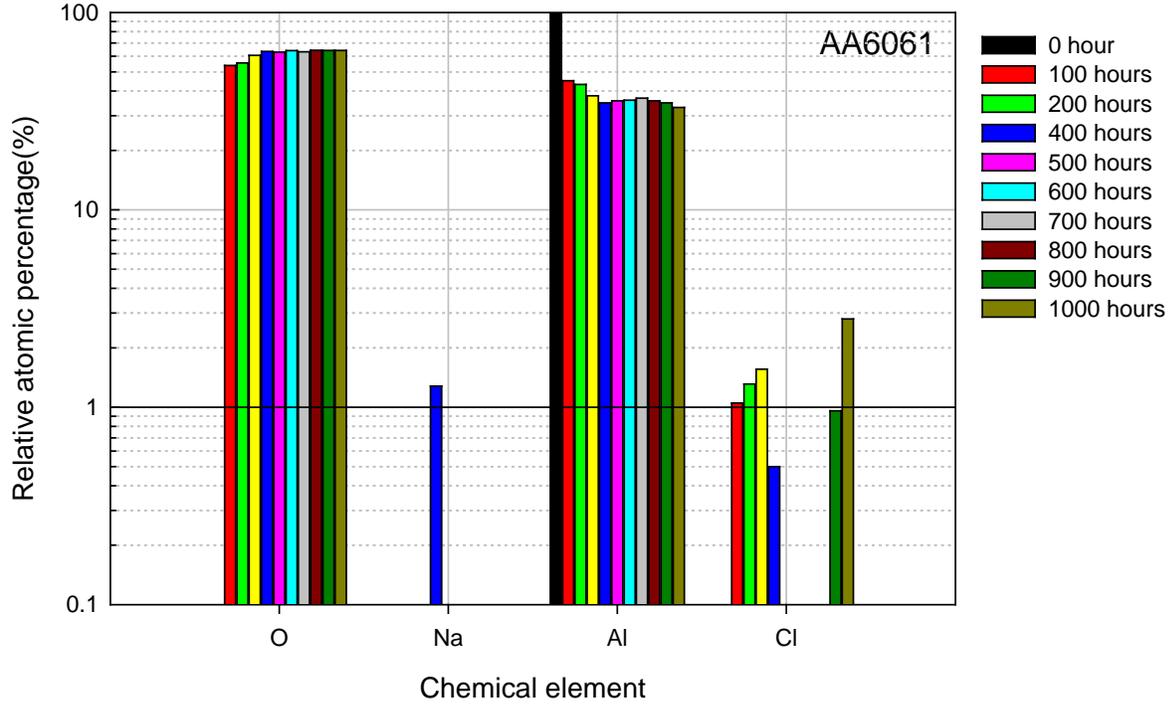


Figure Q - 3. EDS of aluminum alloy 6061 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

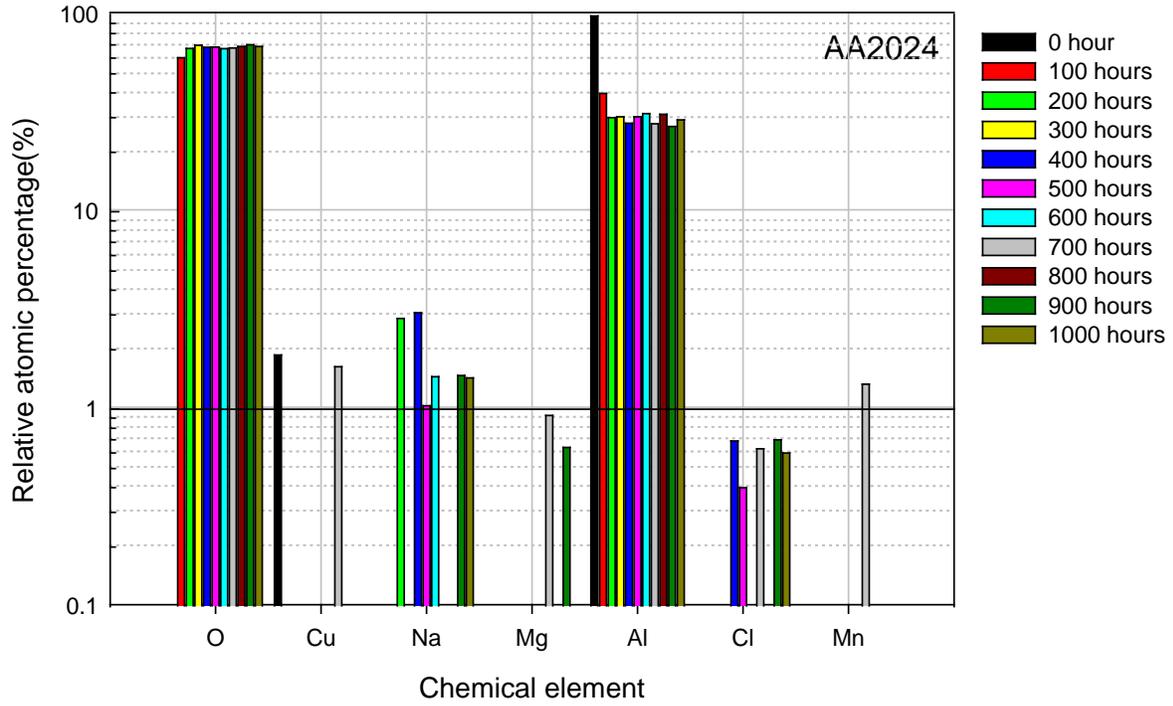


Figure Q - 4. EDS of aluminum alloy 2024 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

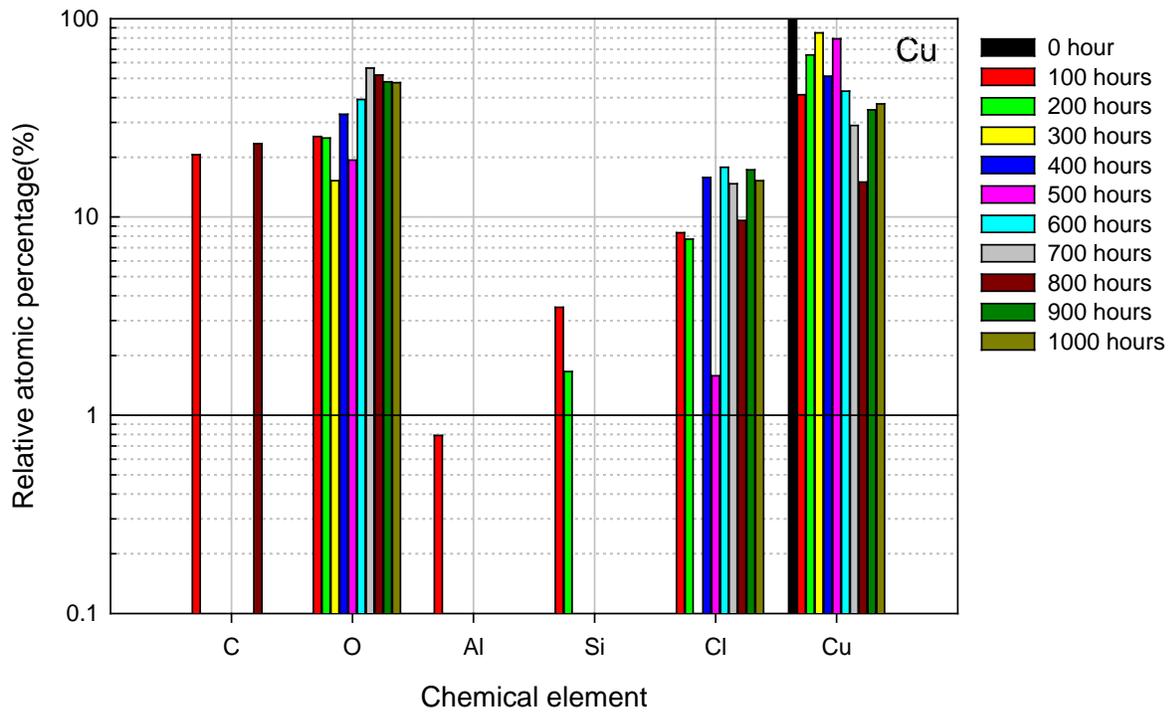


Figure Q - 5. EDS of pure copper samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

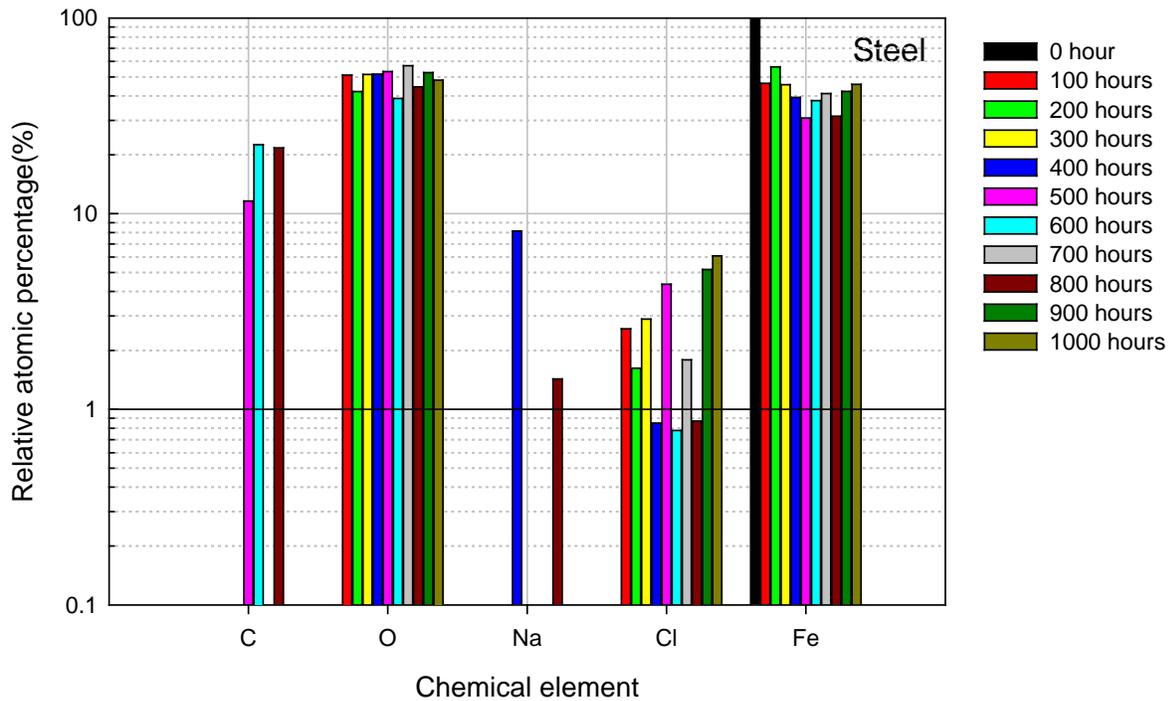


Figure Q - 6. EDS of 1010 steel samples retrieved from high UV (0.86 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

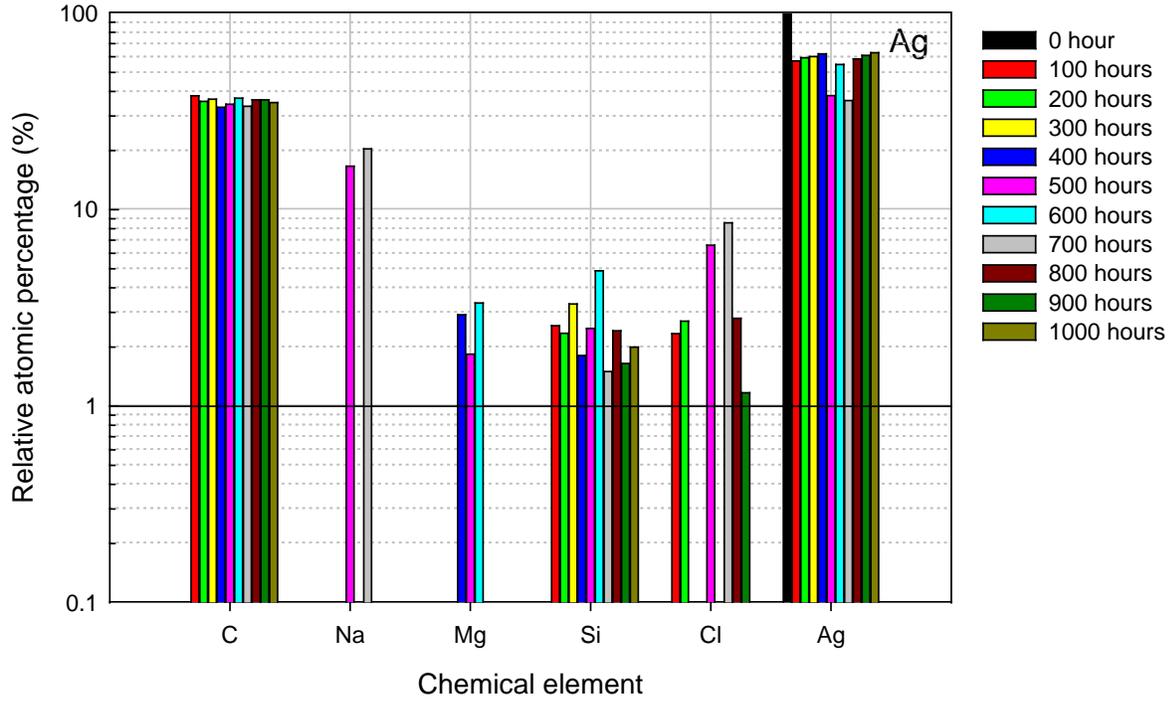


Figure Q - 7. EDS of pure silver samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

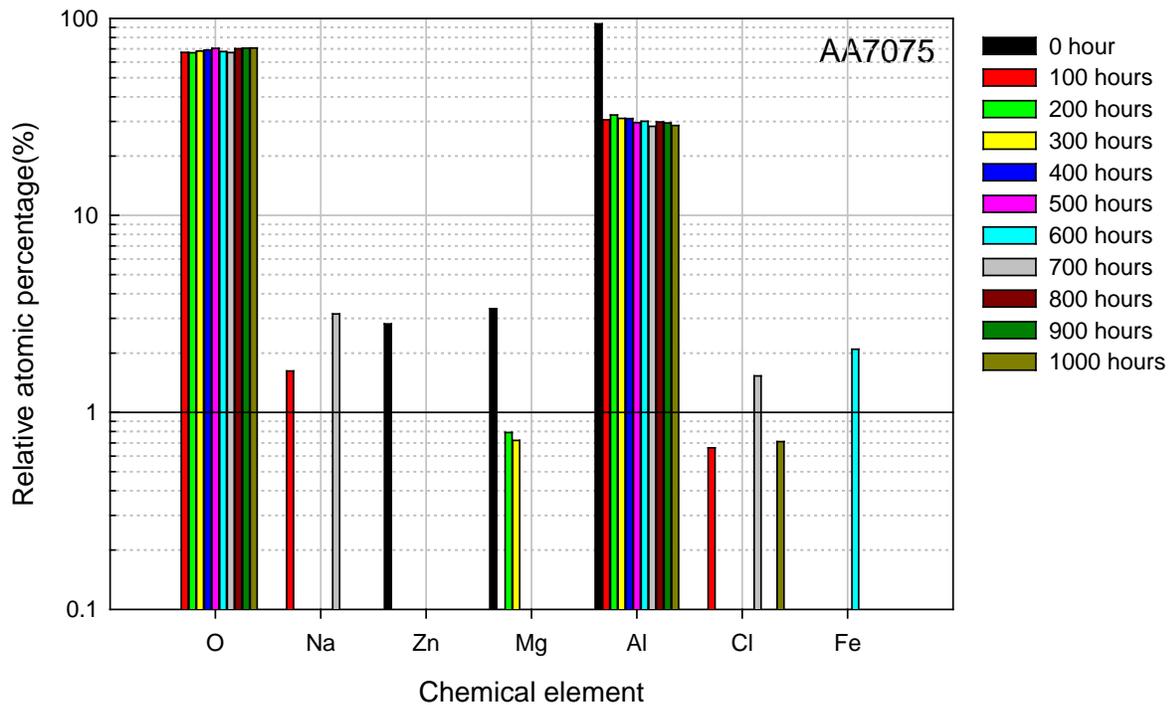


Figure Q - 8. EDS of aluminum alloy 7075 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

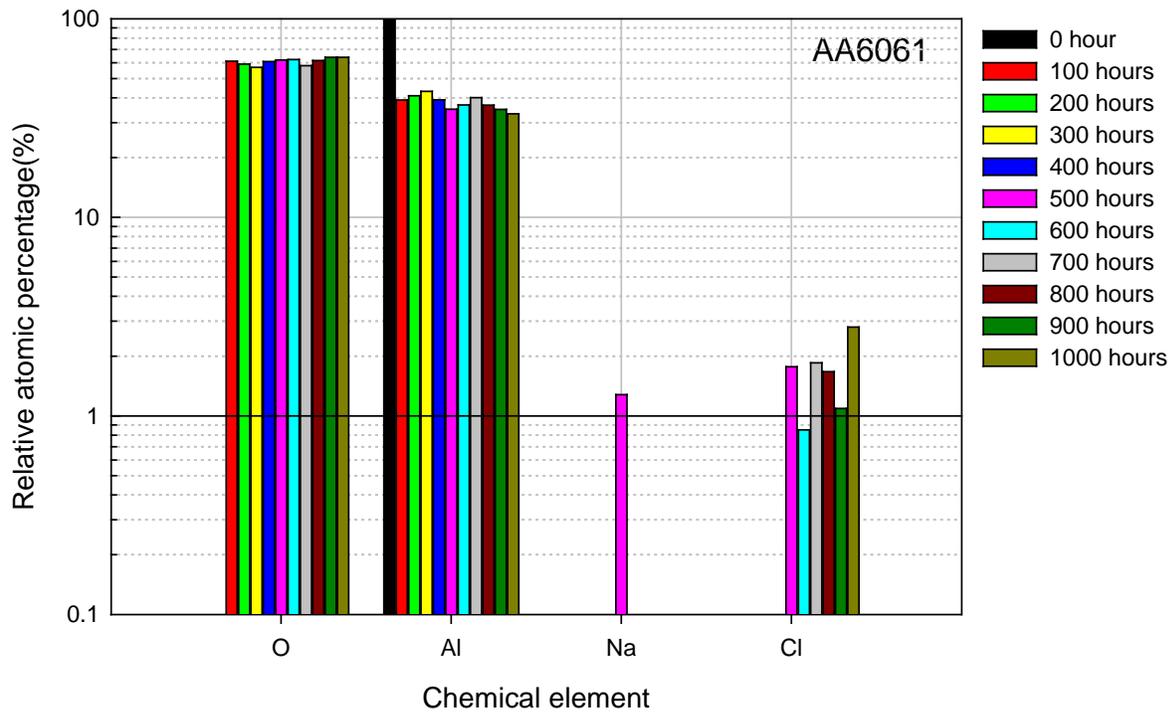


Figure Q - 9. EDS of aluminum alloy 6061 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

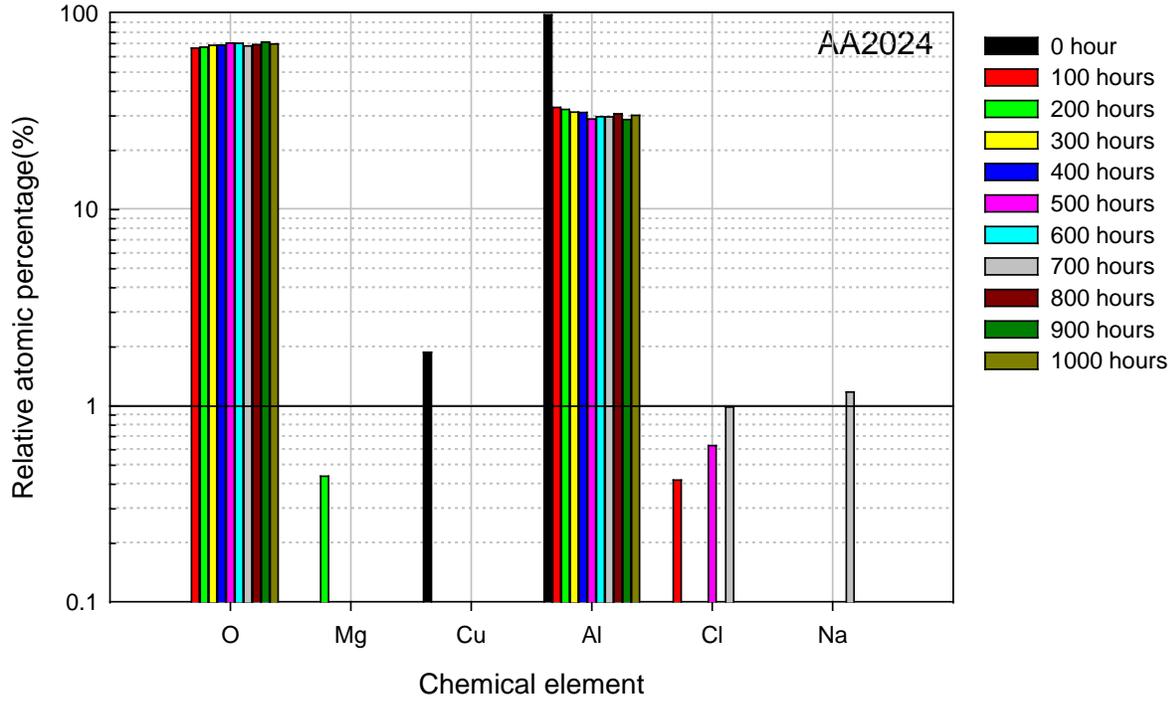


Figure Q - 10. EDS of aluminum alloy 2024 samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

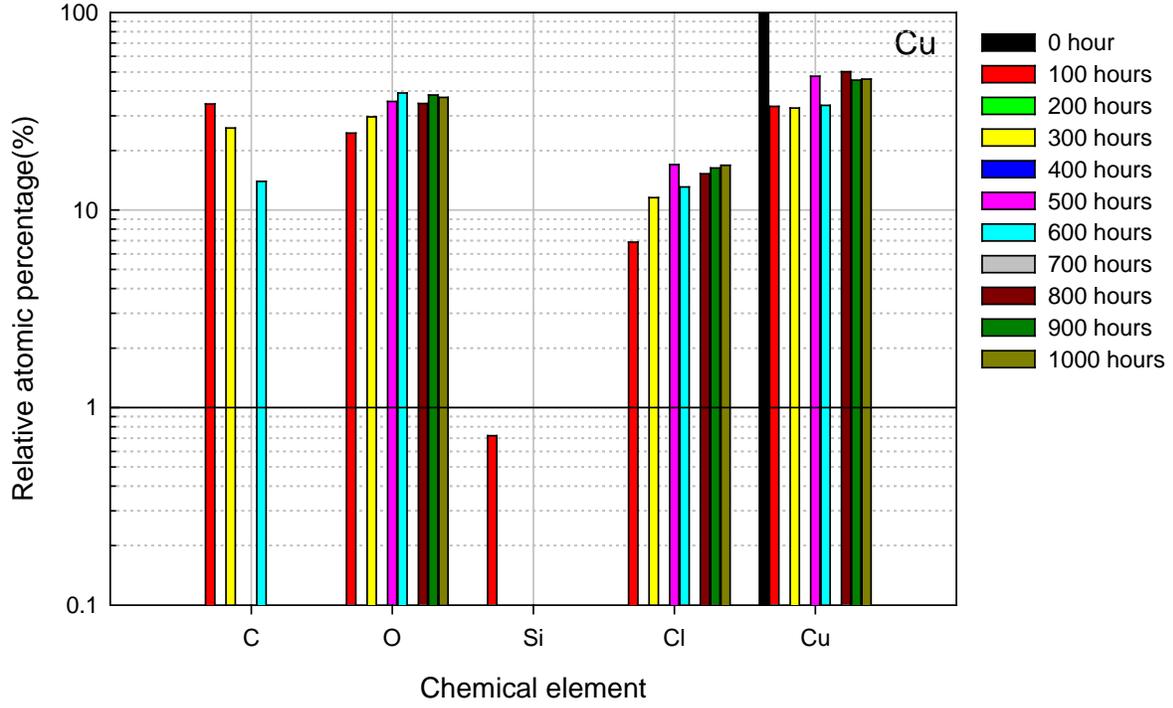


Figure Q - 11. EDS of pure copper samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

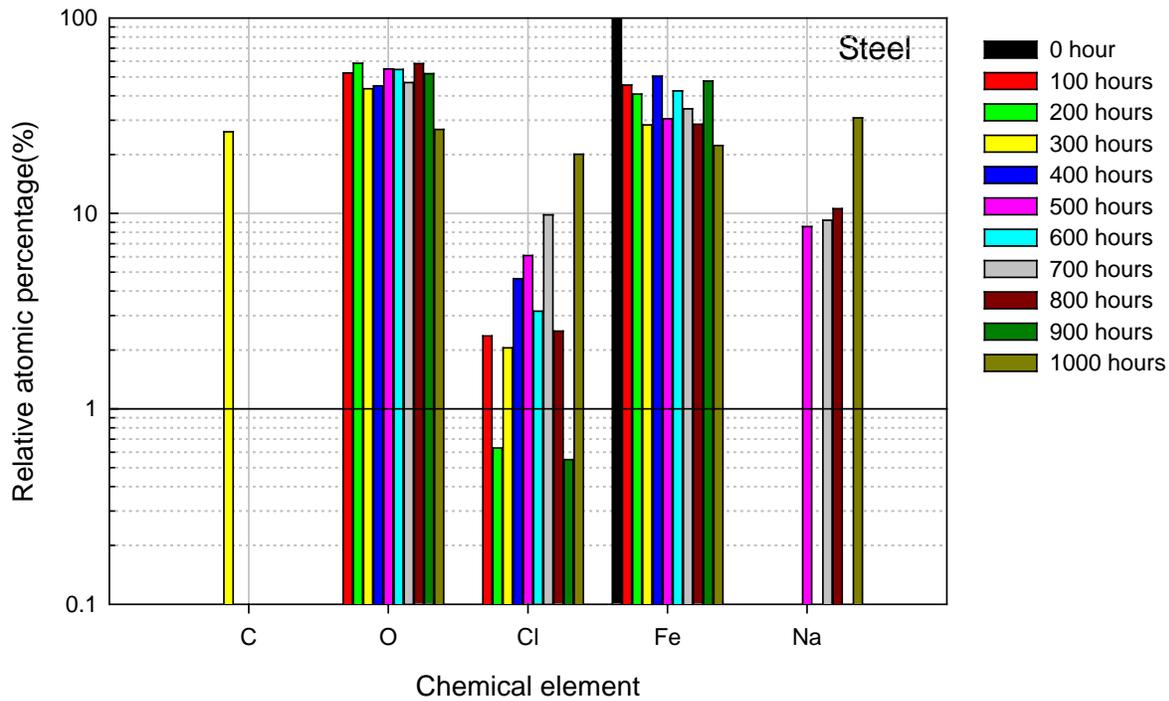


Figure Q - 12. EDS of 1010 steel samples retrieved from high UV (0.86 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

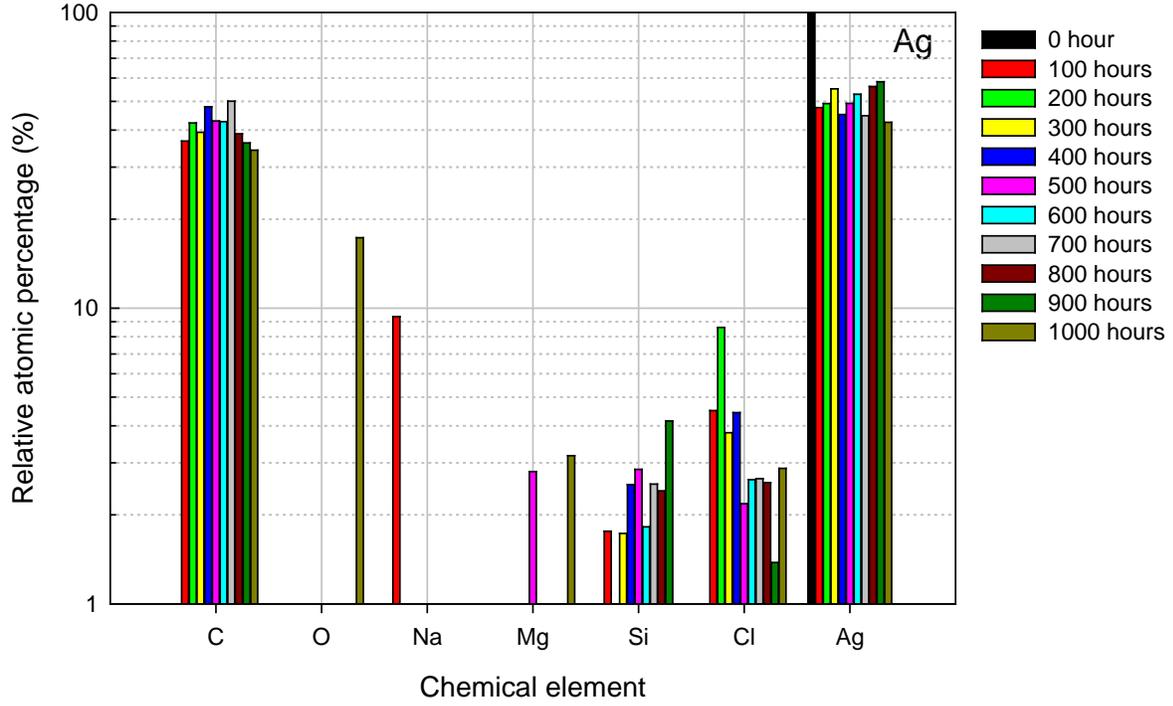


Figure Q - 13. EDS of pure silver samples retrieved from low UV (0.1 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

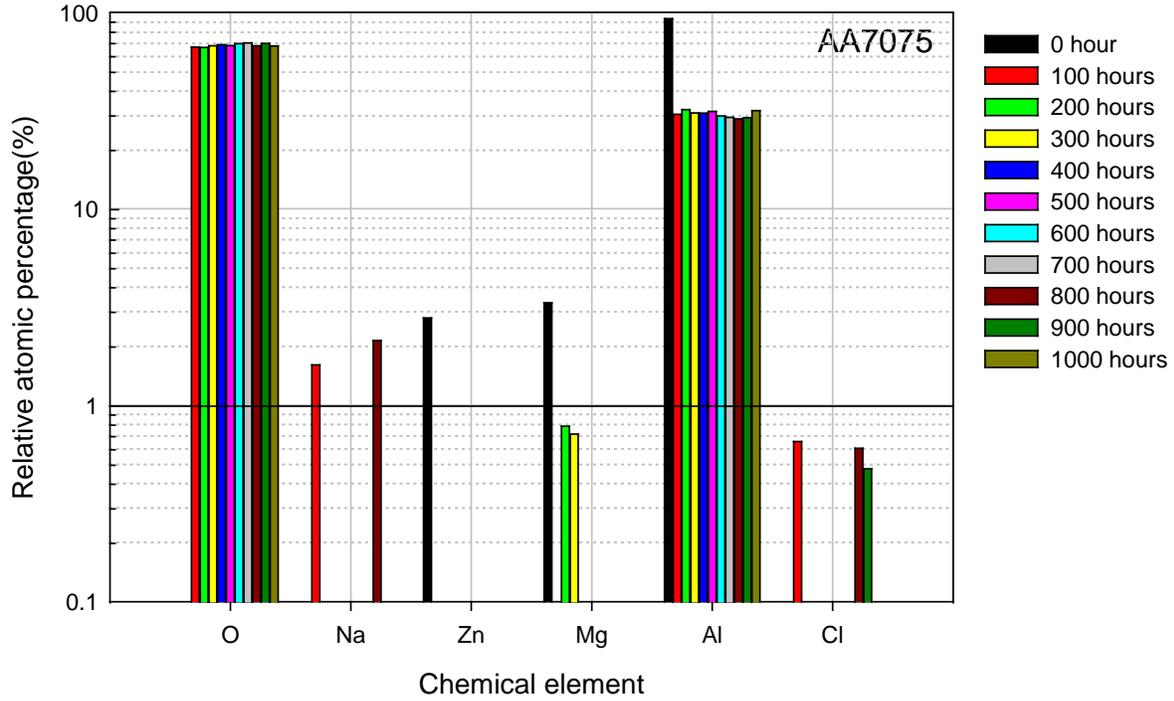


Figure Q - 14. EDS of aluminum alloy 7075 samples retrieved from low UV (0.1 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

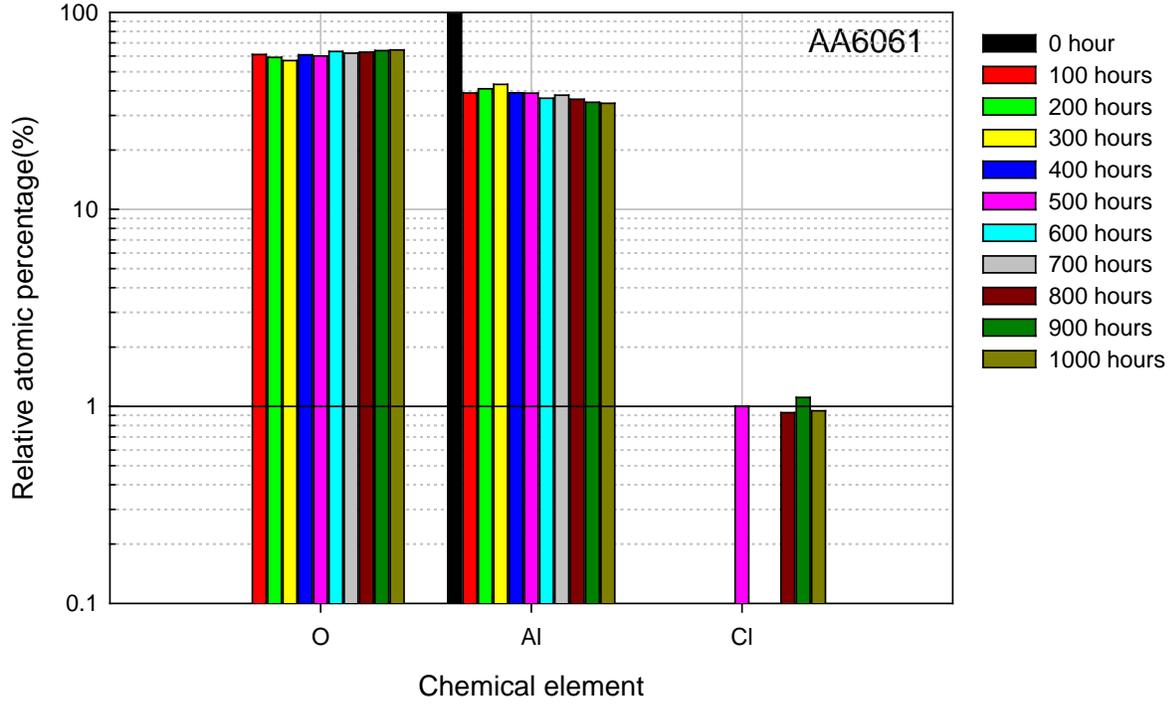


Figure Q - 15. EDS of aluminum alloy 6061 samples retrieved from low UV (0.1 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

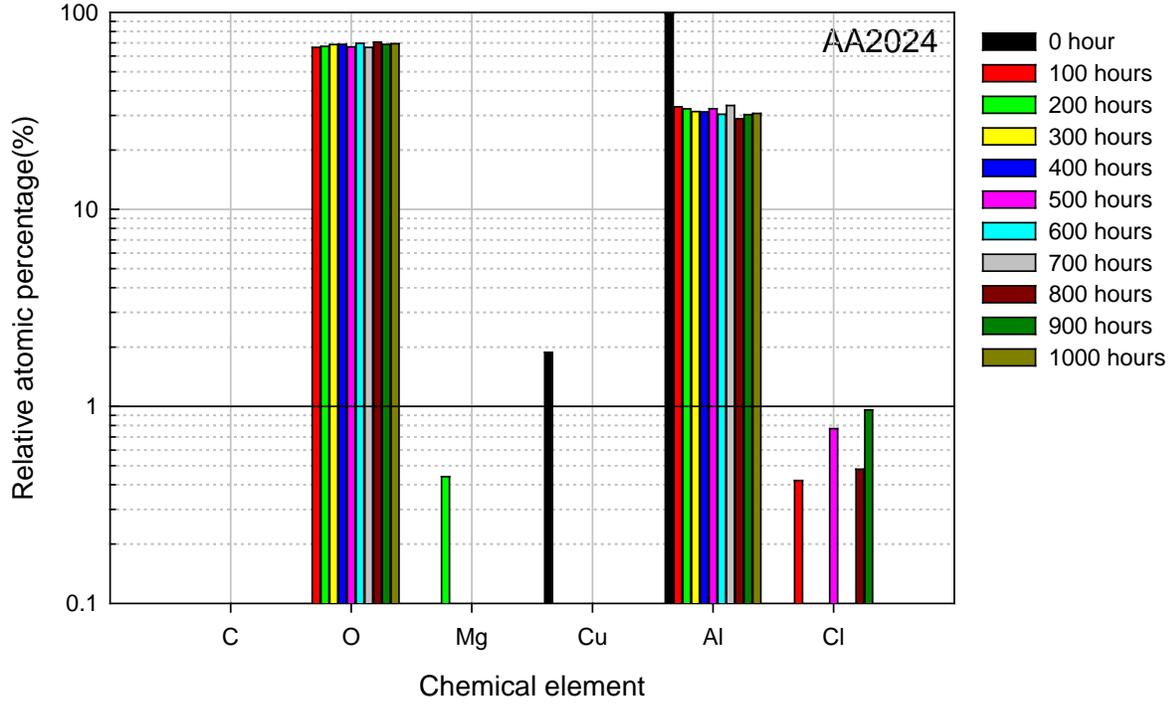


Figure Q - 16. EDS of aluminum alloy 2024 samples retrieved from low UV (0.1 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

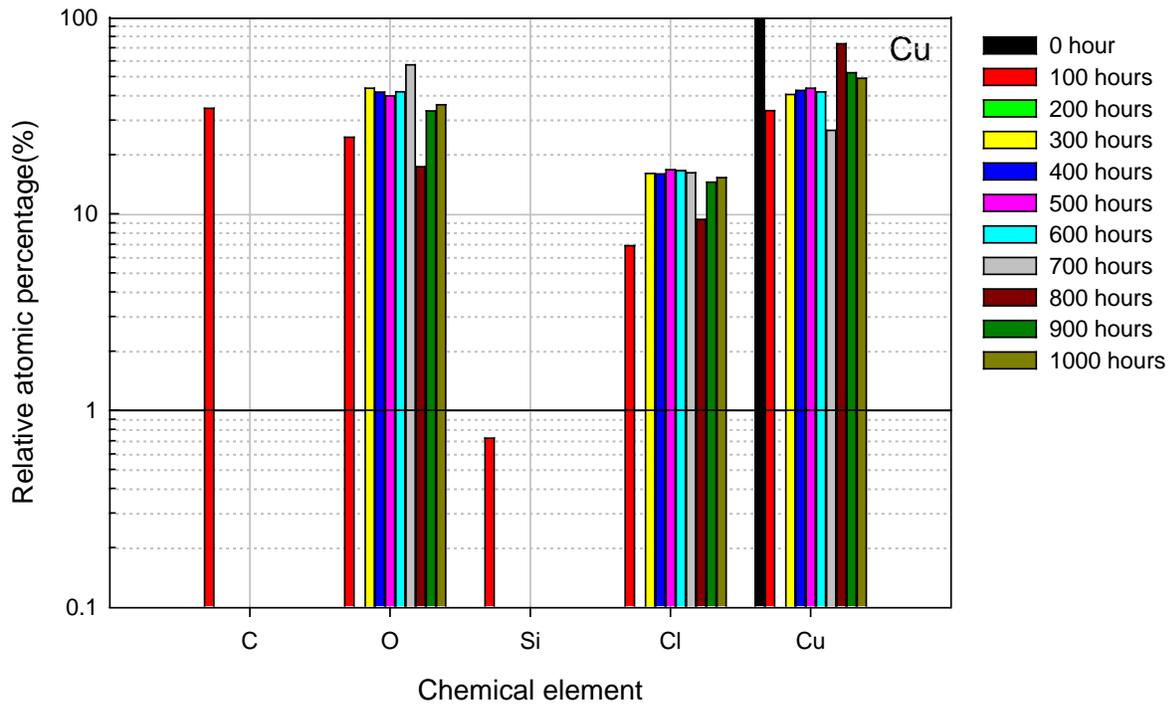


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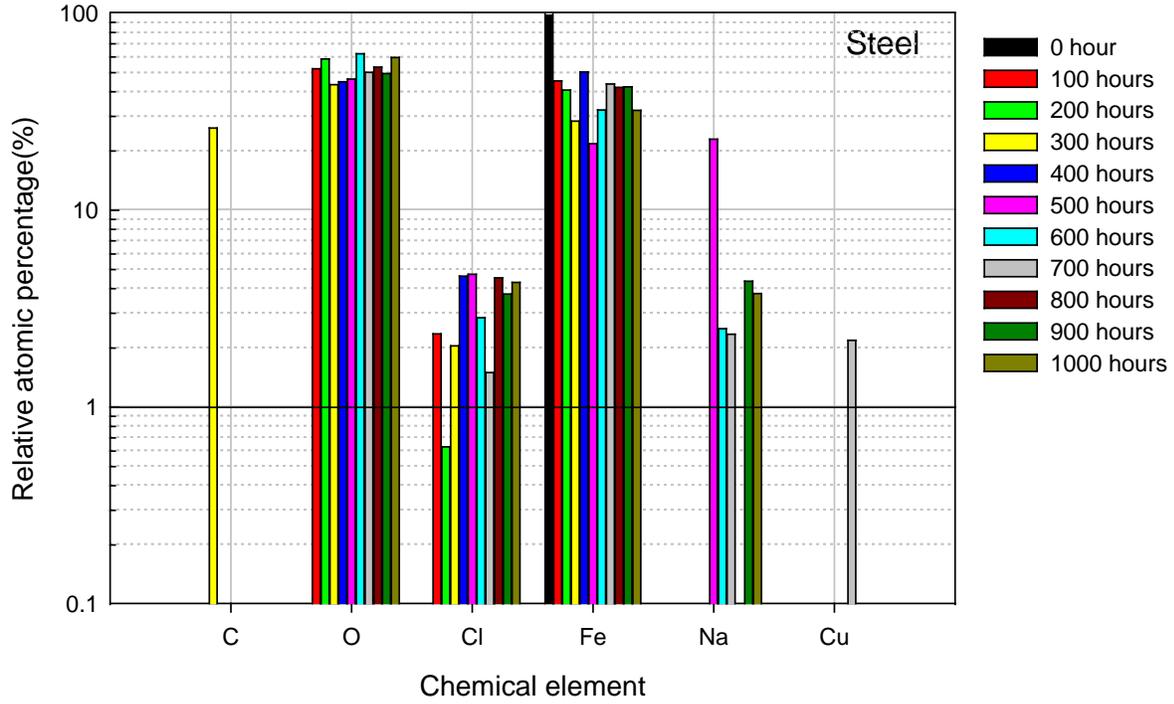


Figure Q - 18. EDS of 1010 steel samples retrieved from low UV (0.1 W/m<sup>2</sup>) and high Ozone (800 ppb) chamber

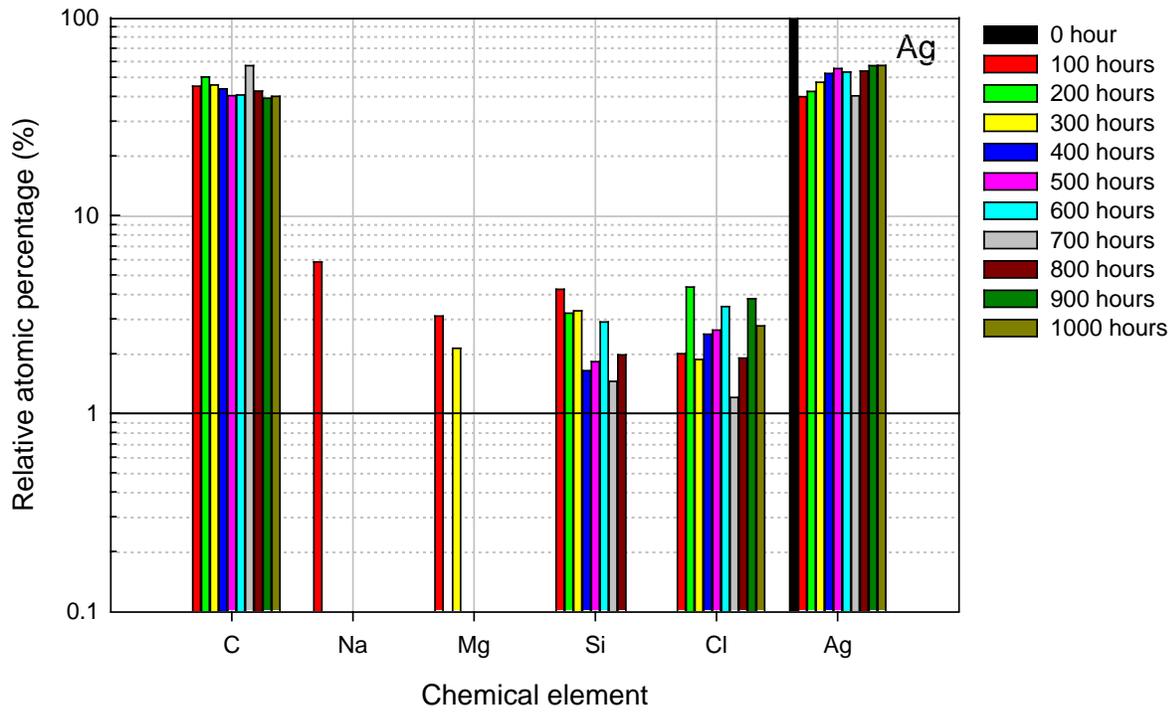


Figure Q - 19. EDS of pure silver samples retrieved from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

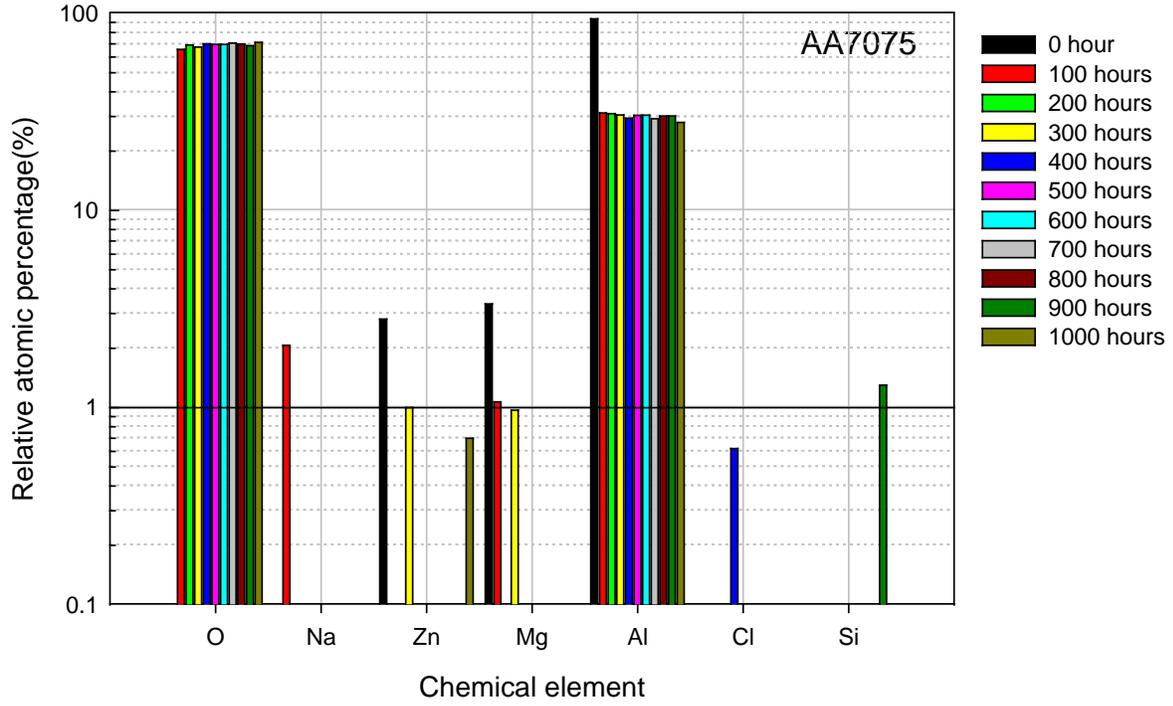


Figure Q - 20. EDS of aluminum alloy 7075 samples retrieved from low UV (0.1 W/m<sup>2</sup>) and low Ozone (100 ppb) chamber

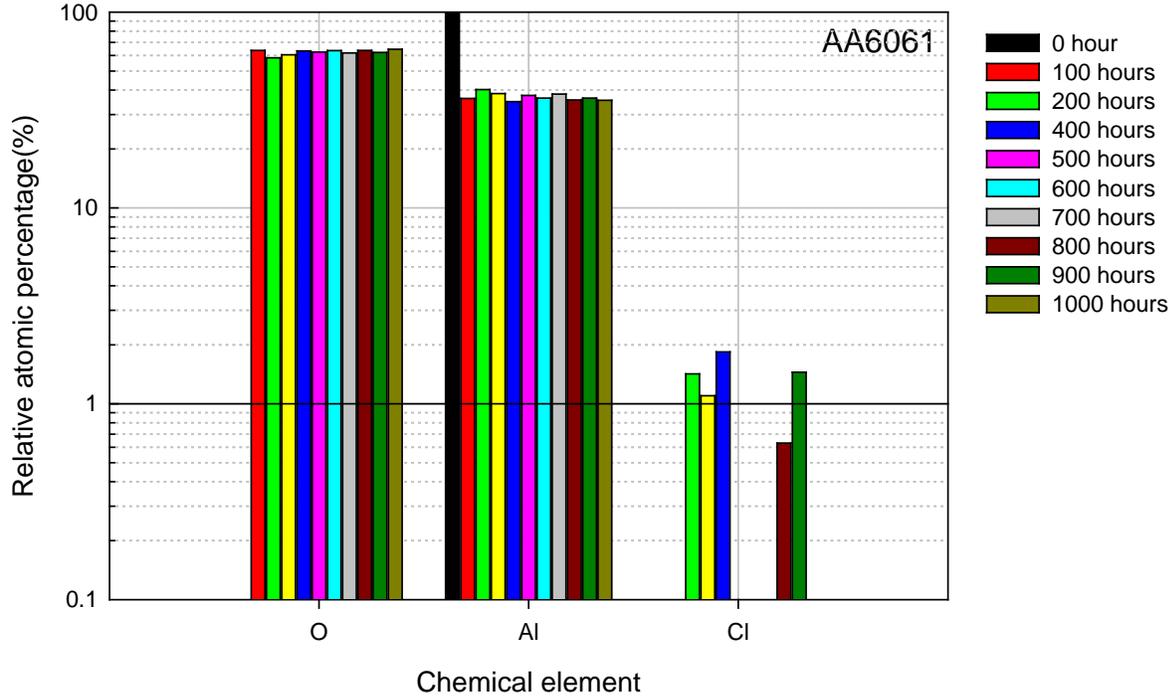


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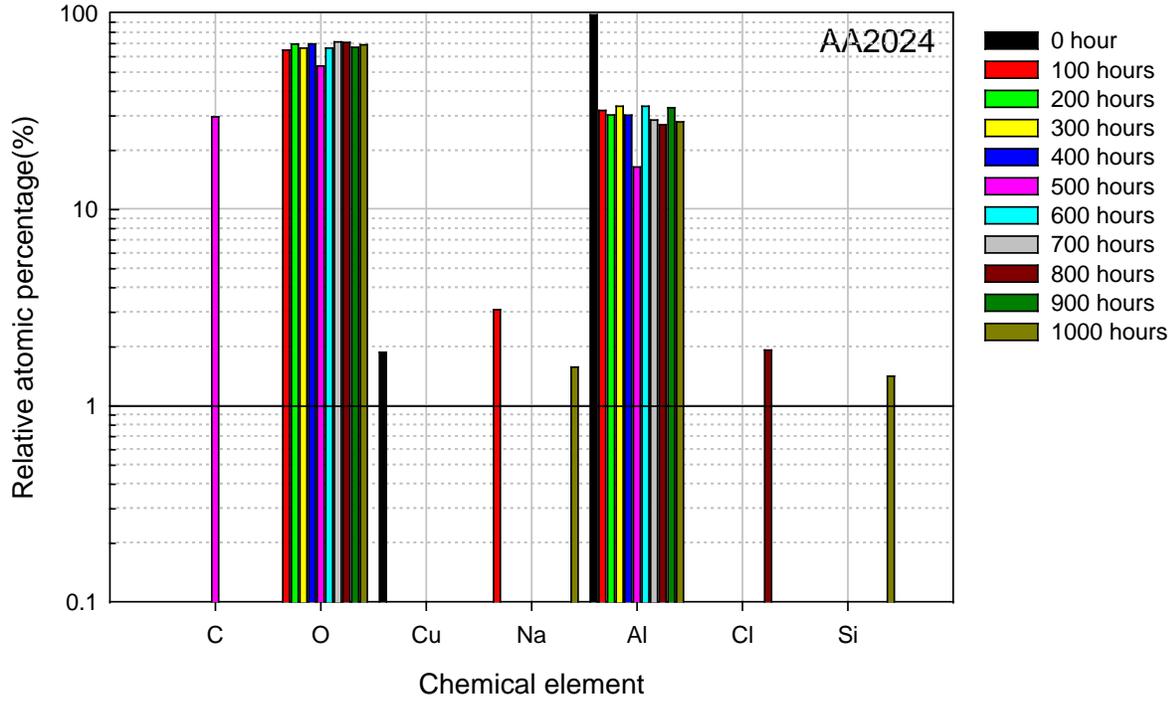


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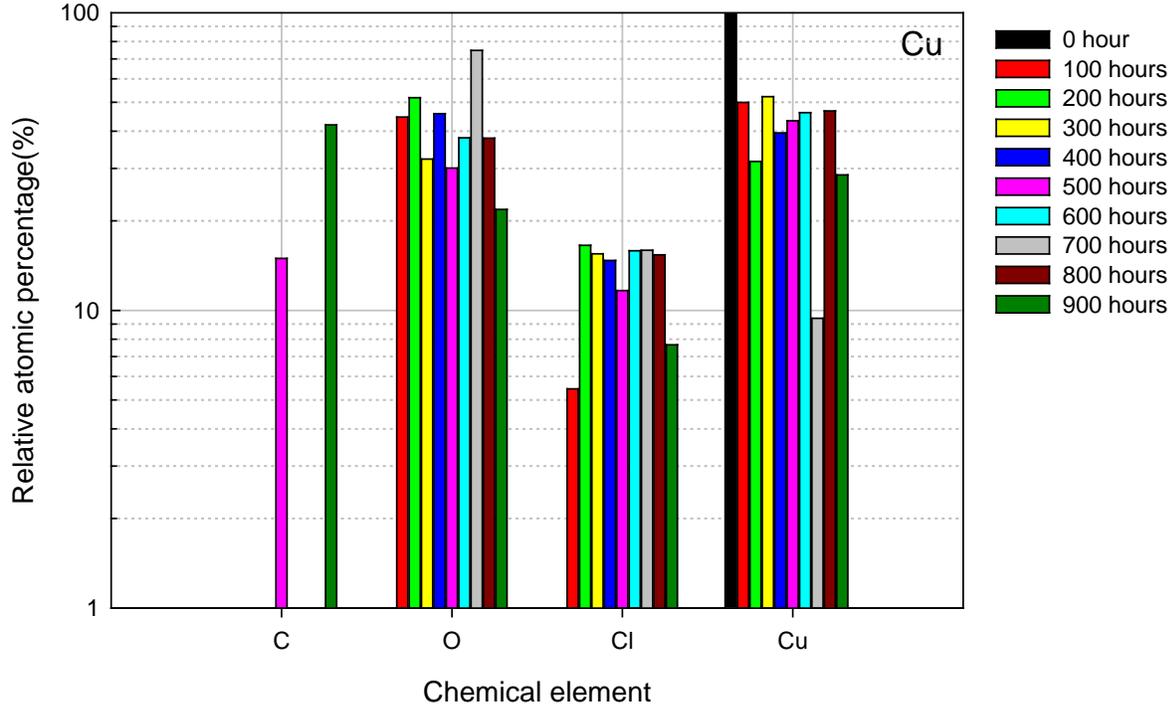


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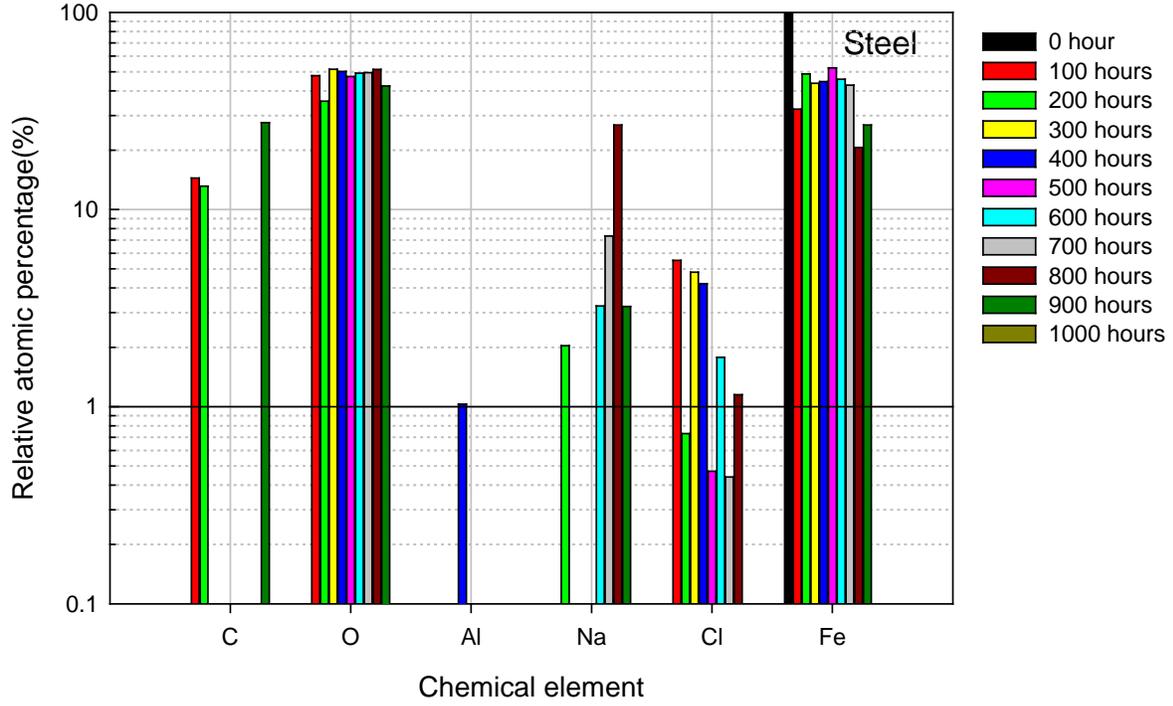


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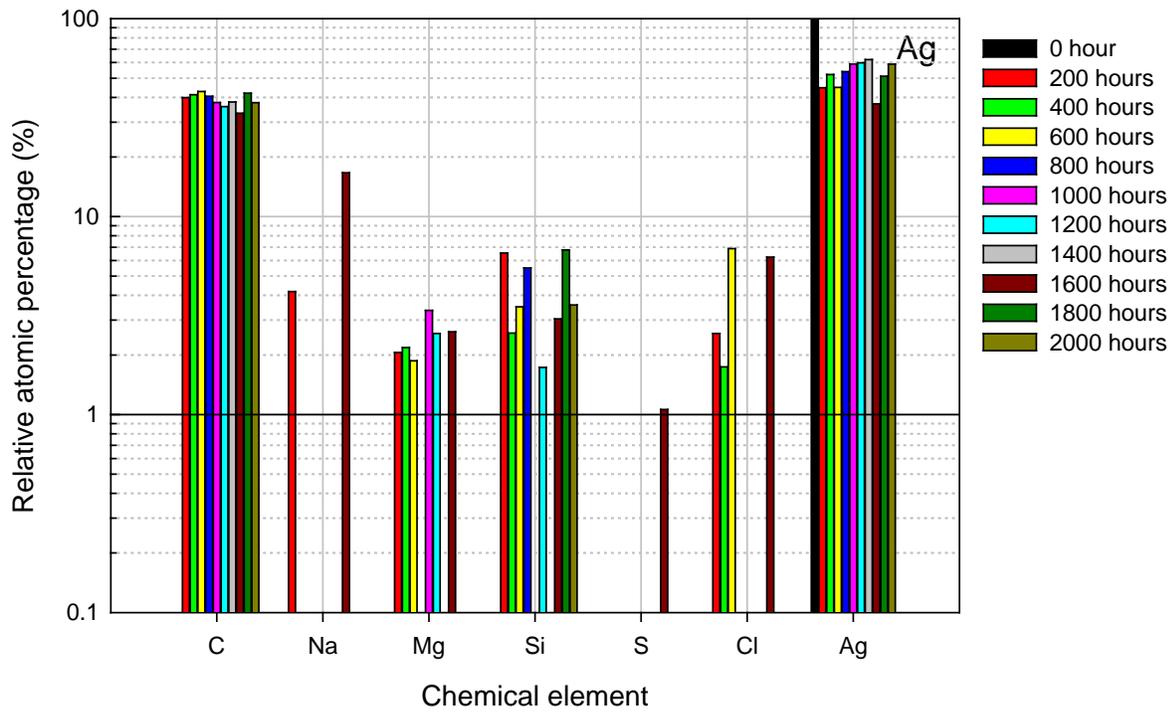


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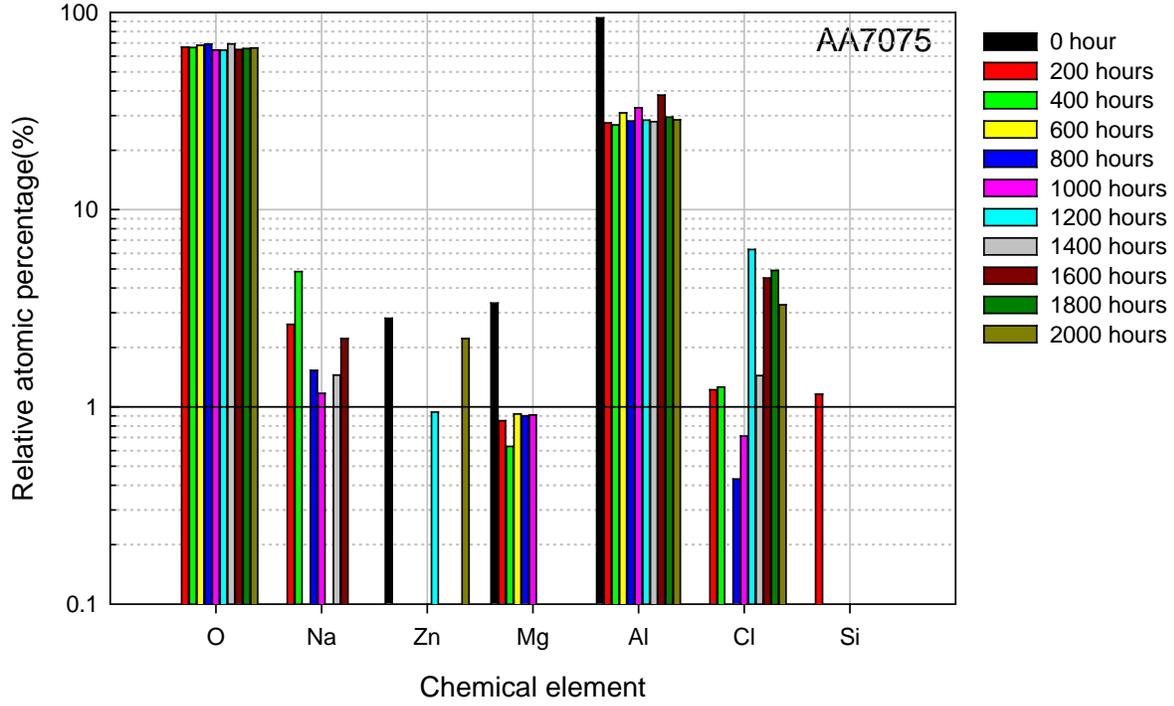


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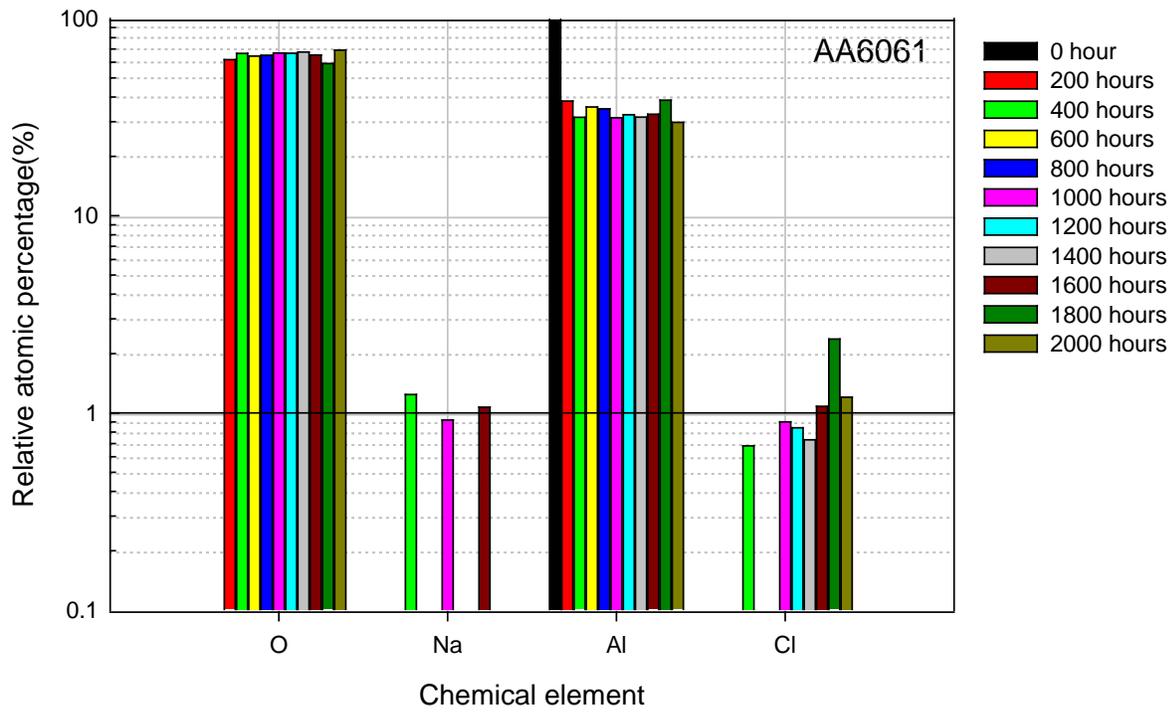


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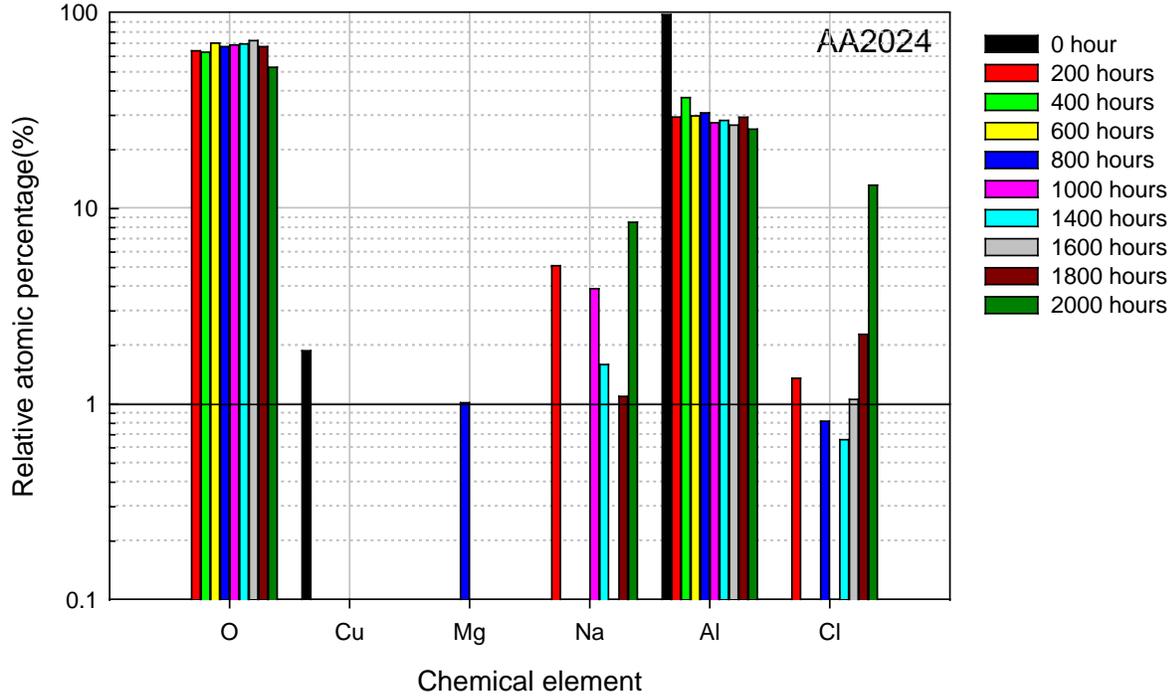


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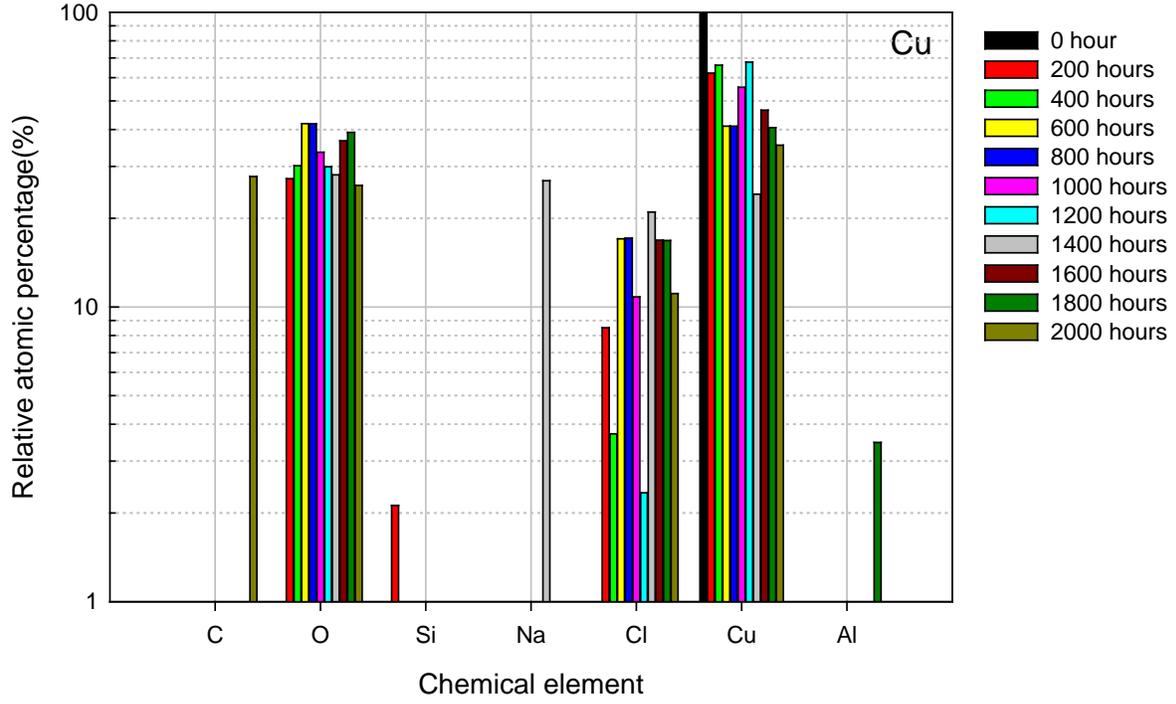


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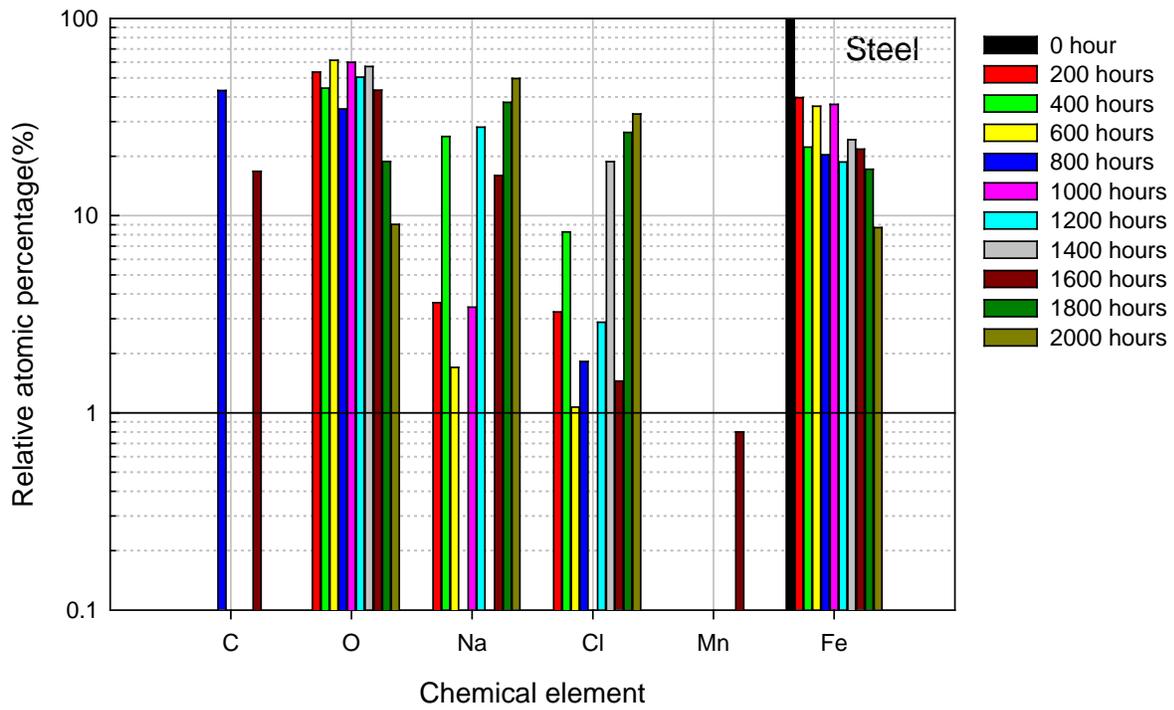


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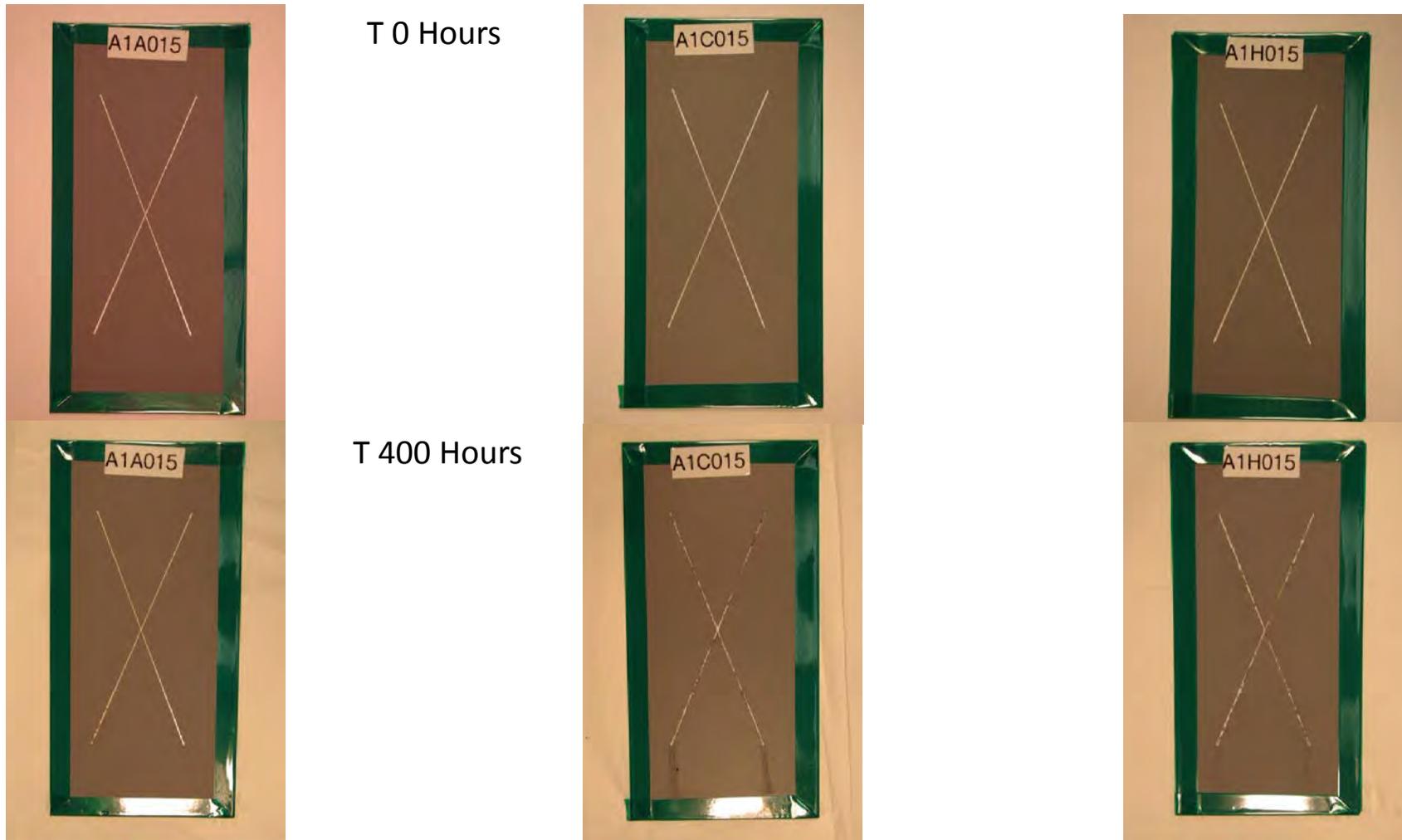


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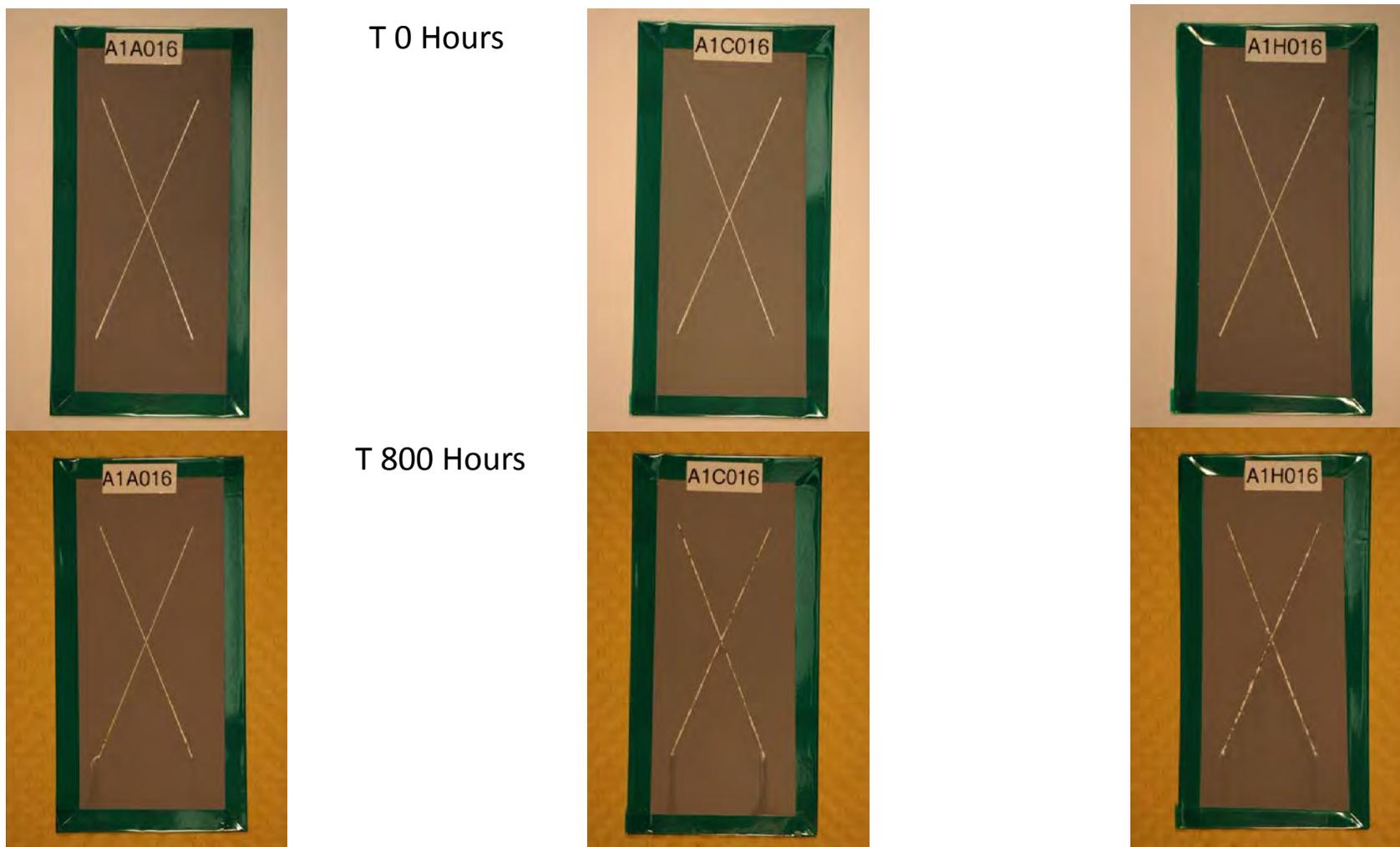


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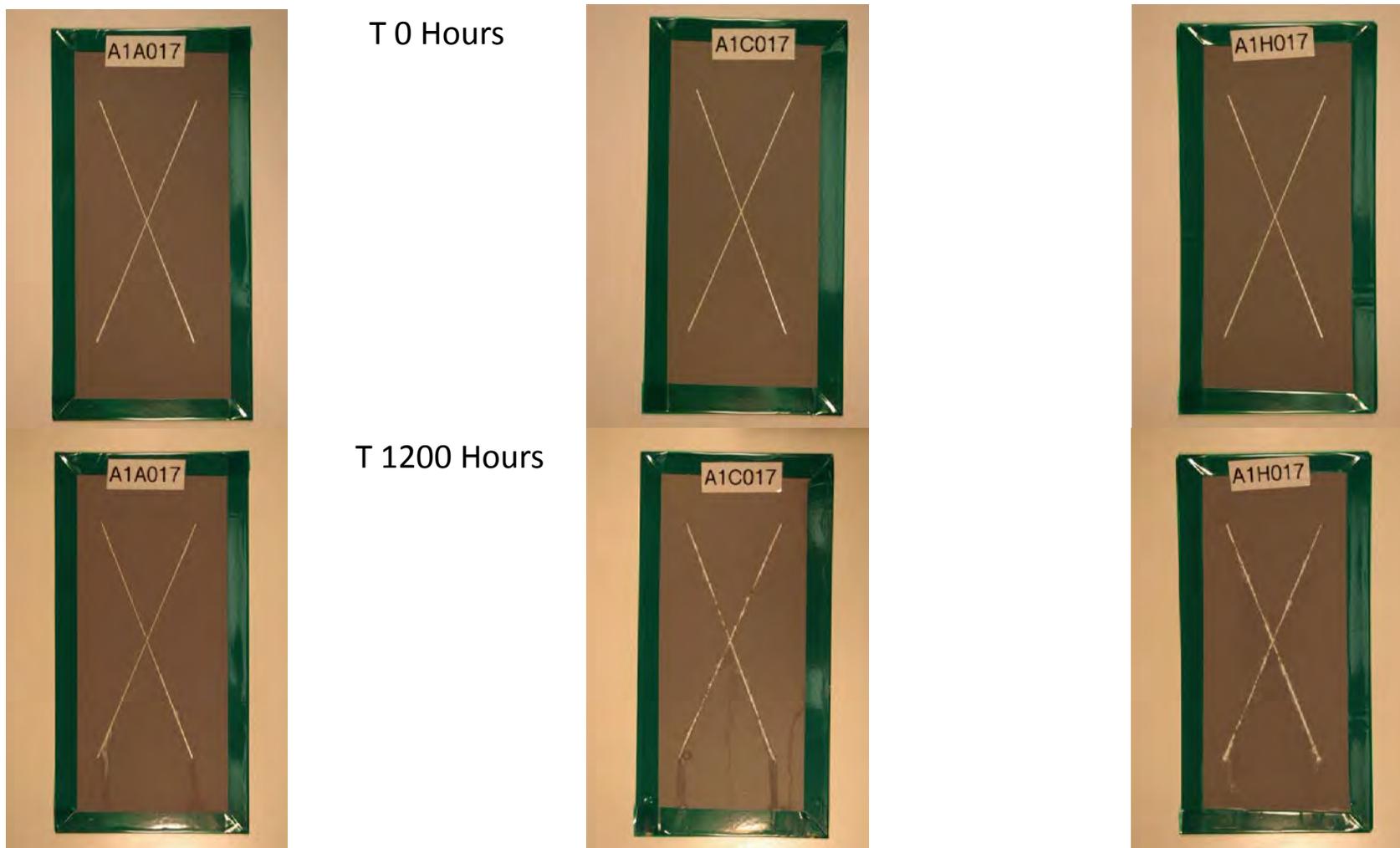


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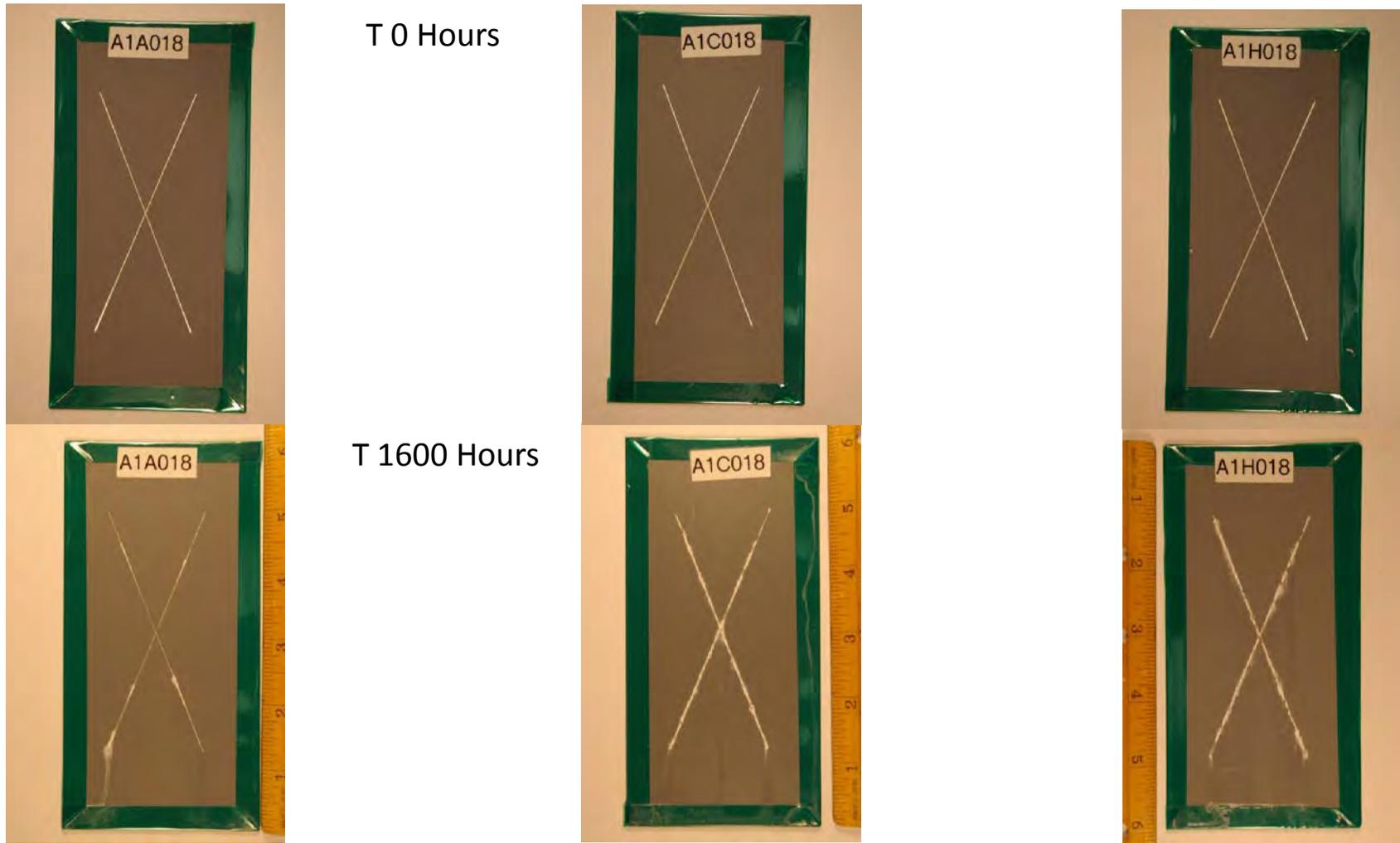


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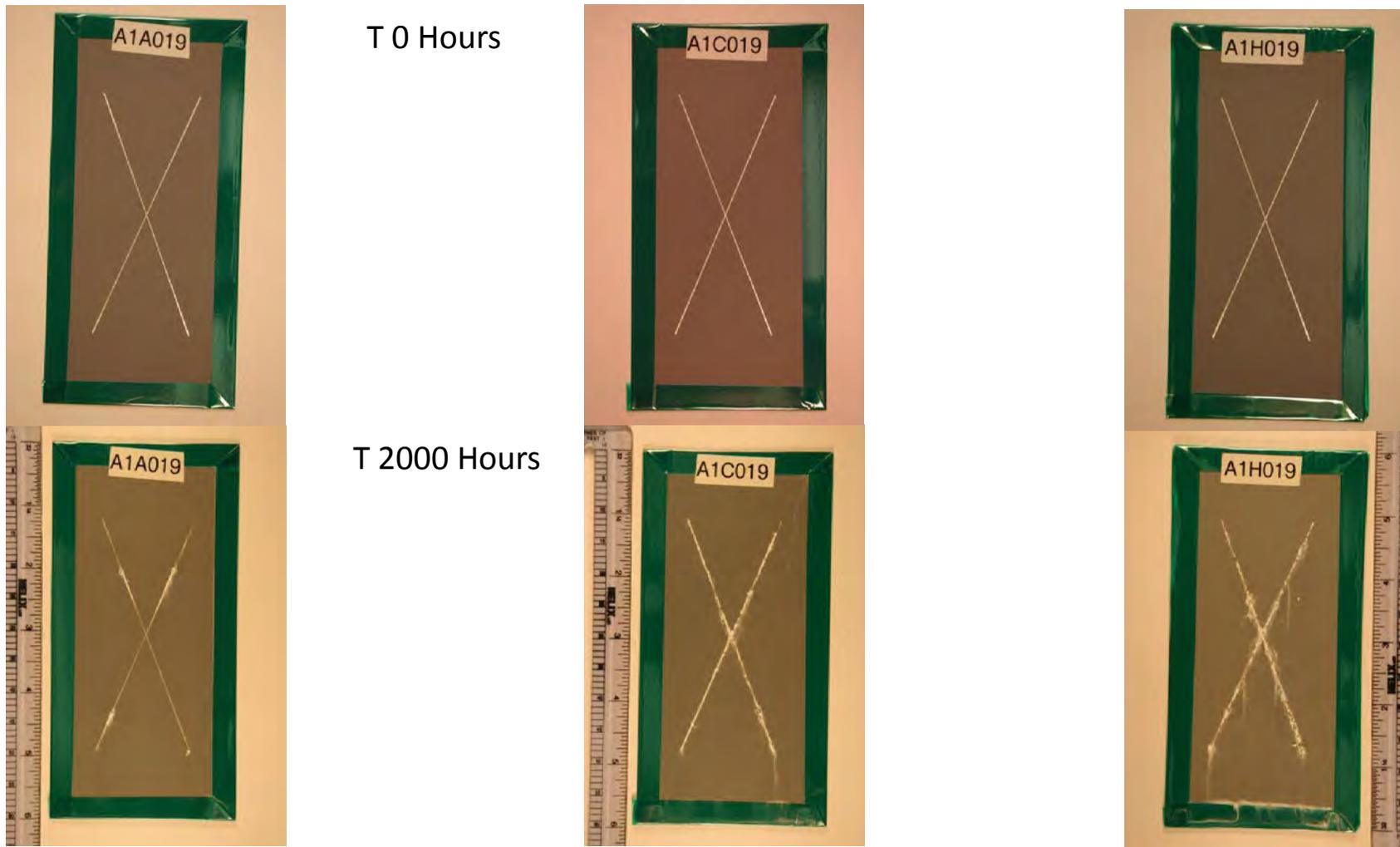


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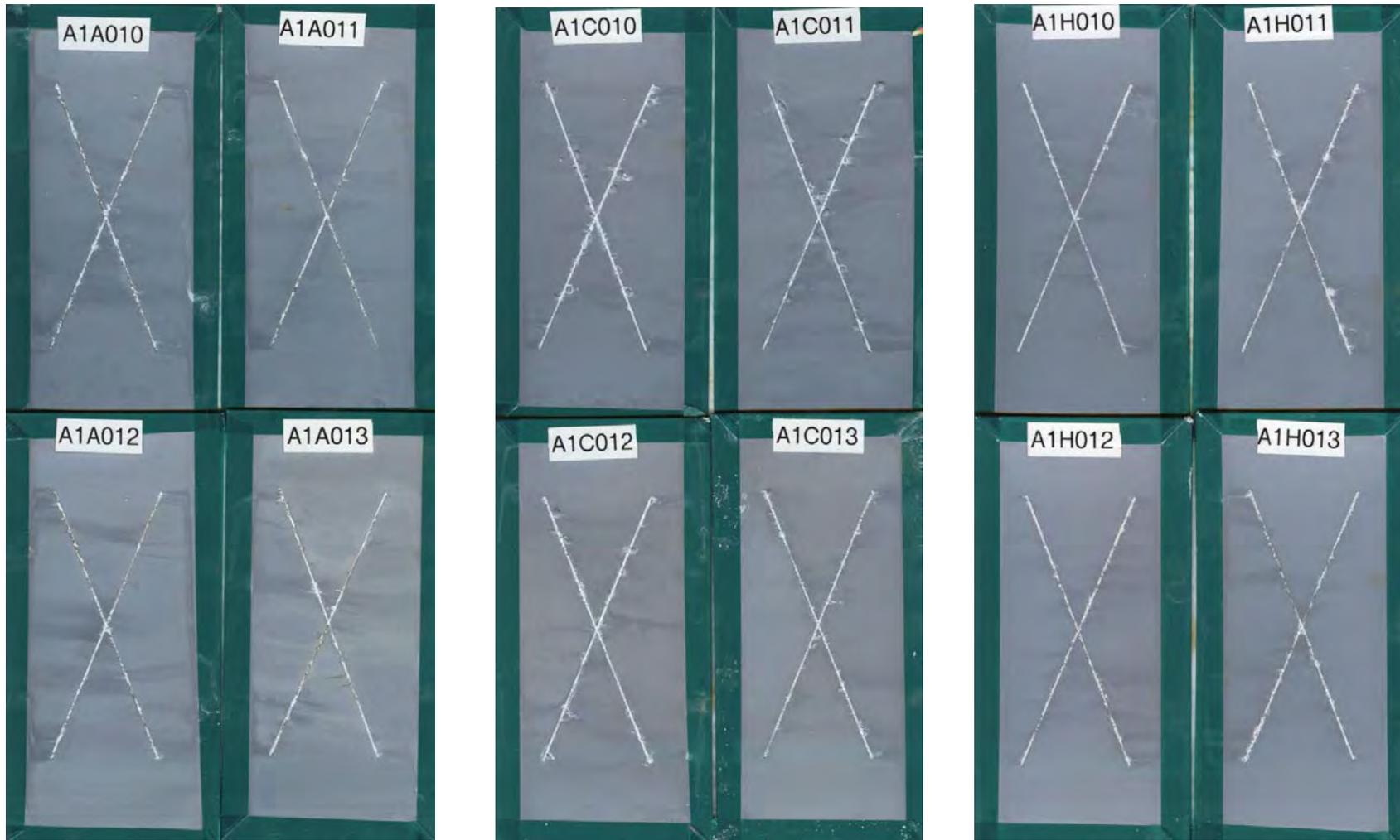


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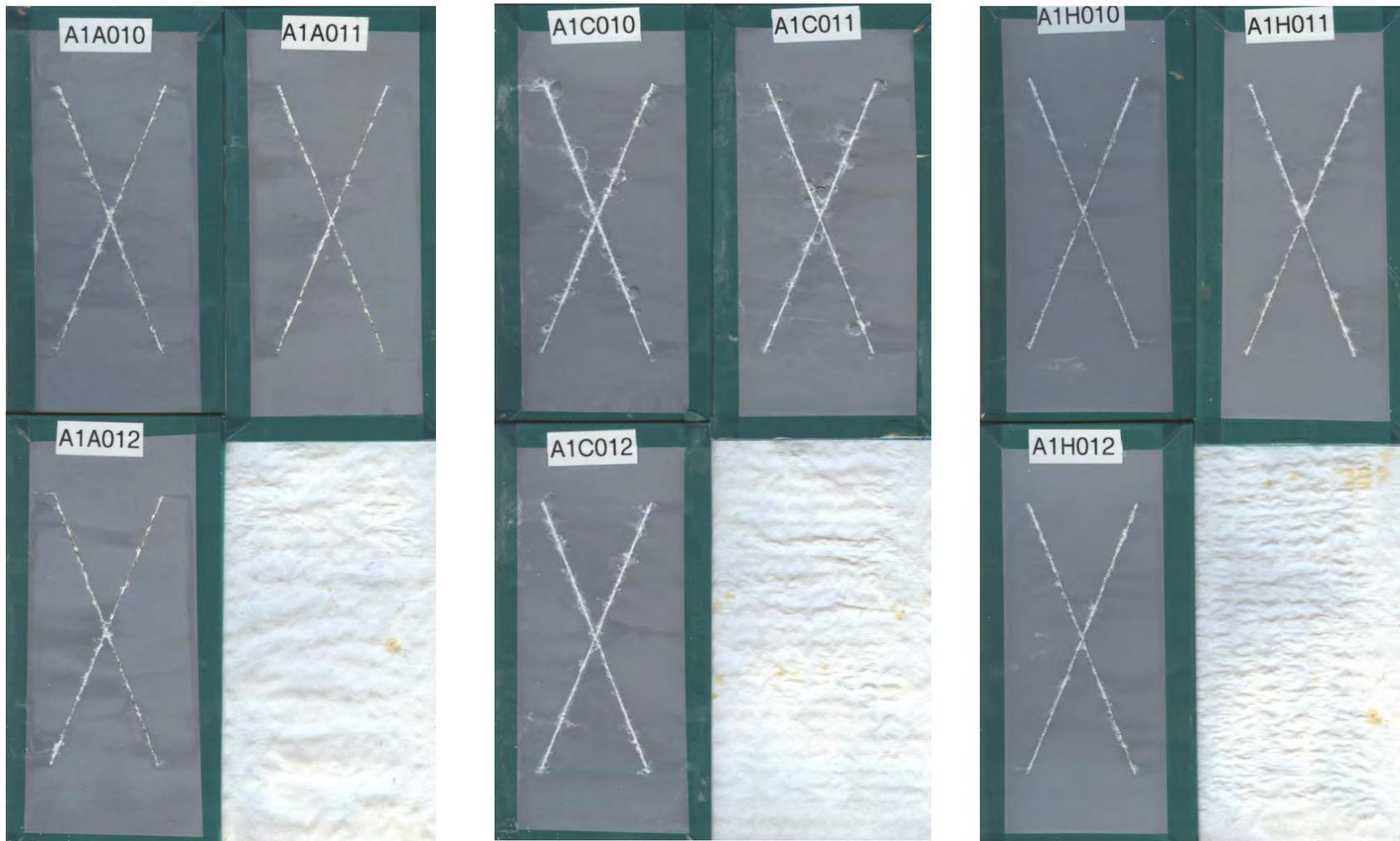


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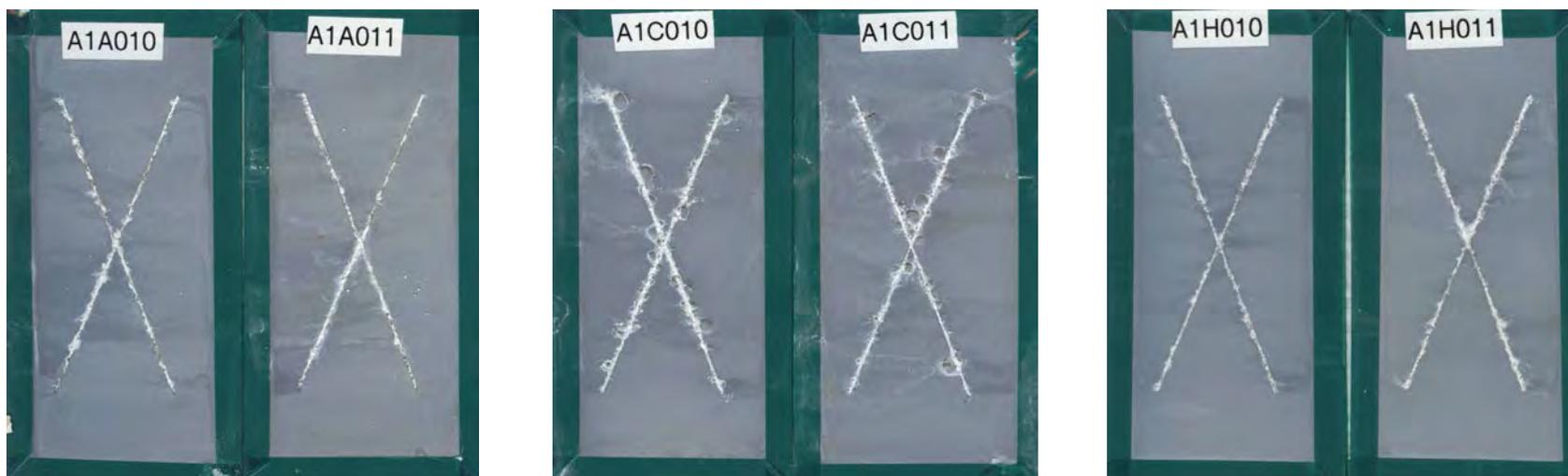


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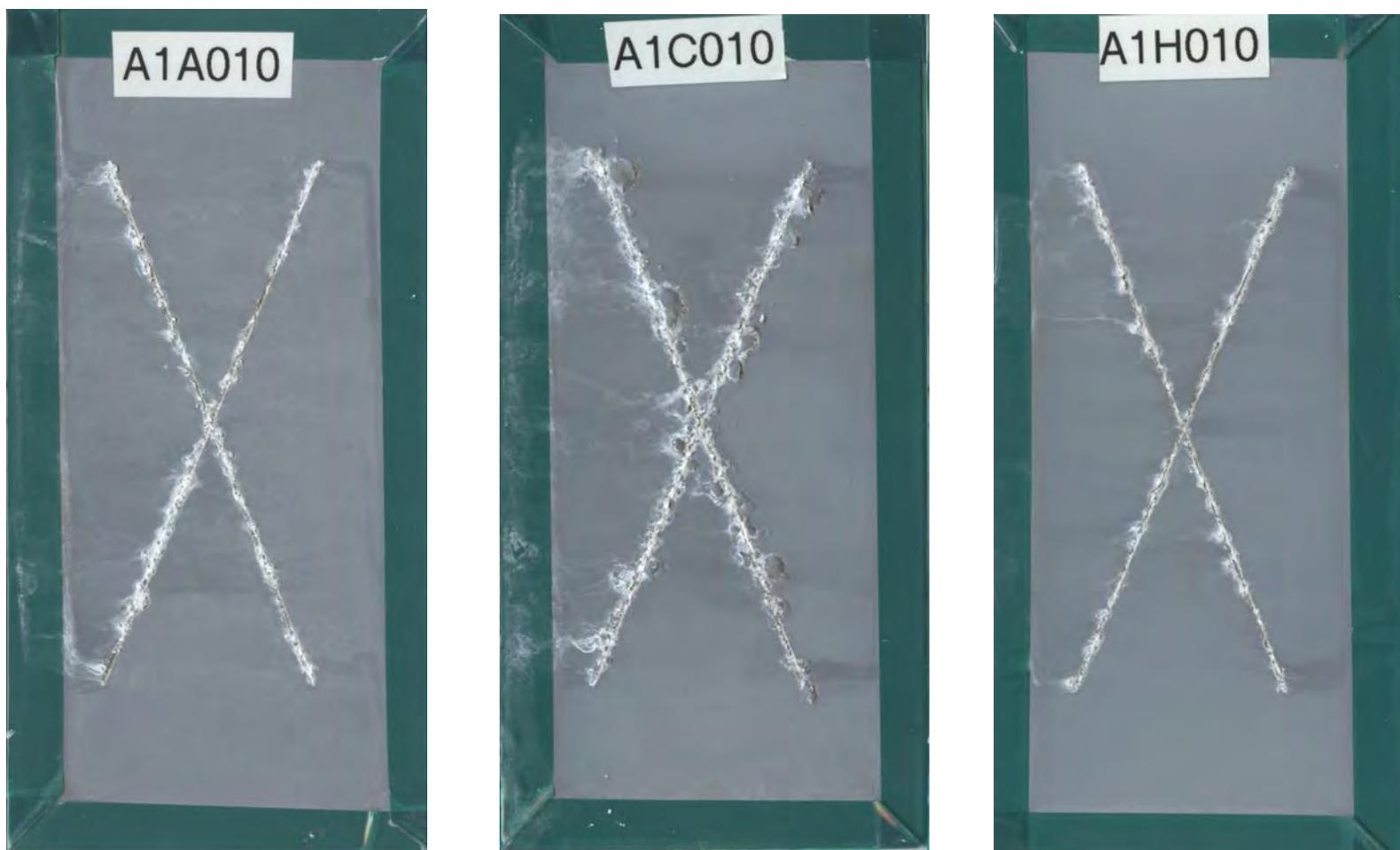


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**Appendix S**  
EDS Data for All Chamber Exposures  
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Coated Panels

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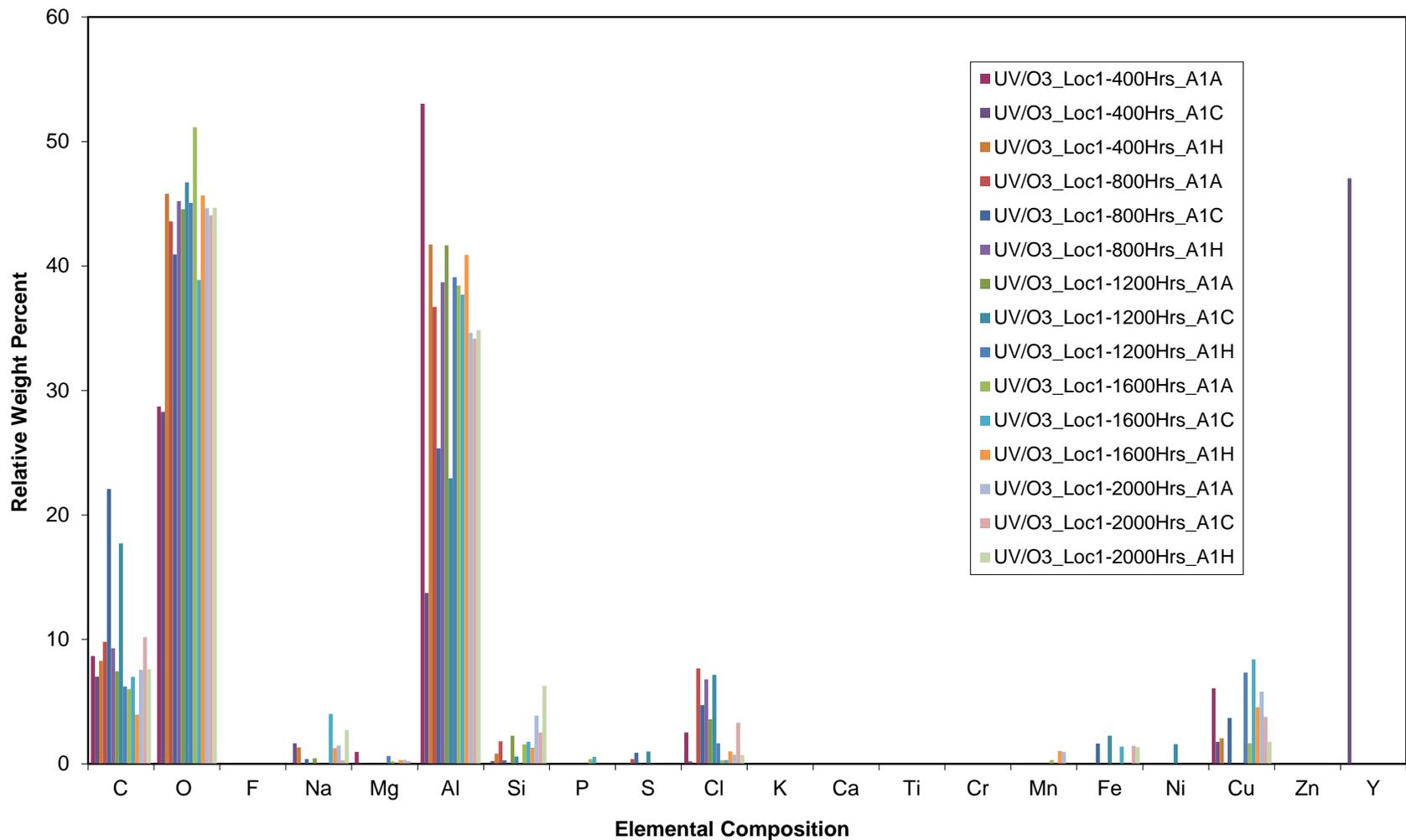


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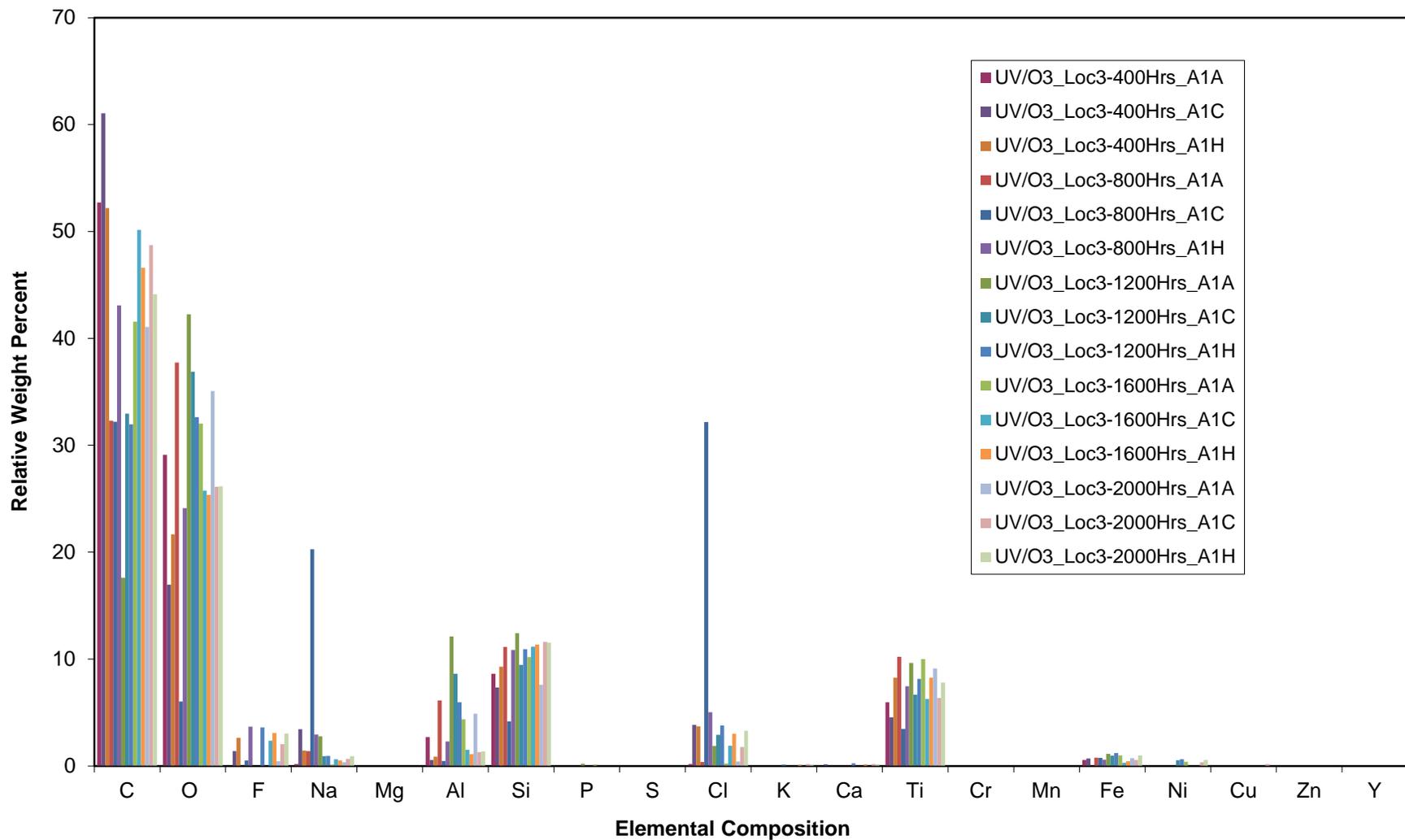


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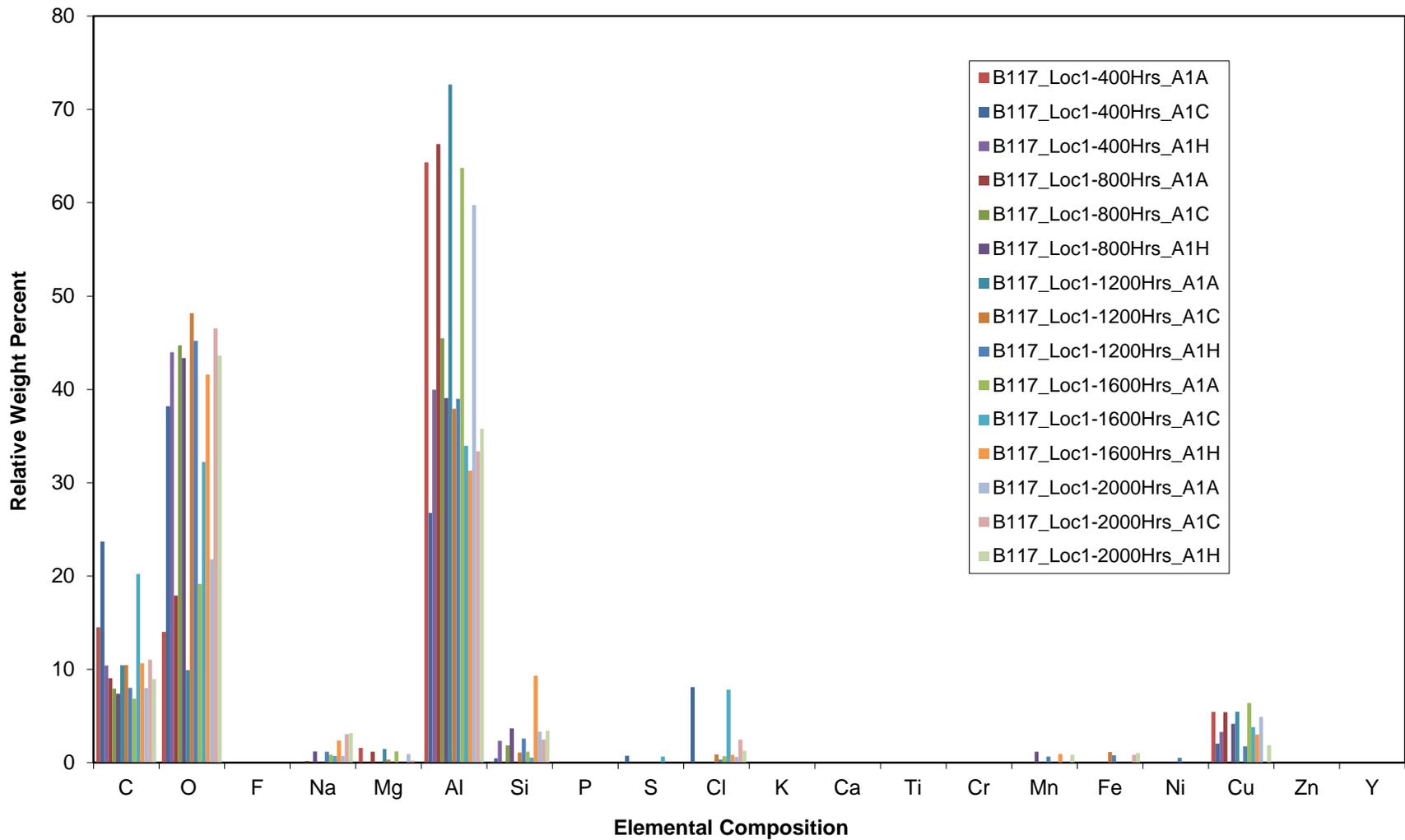


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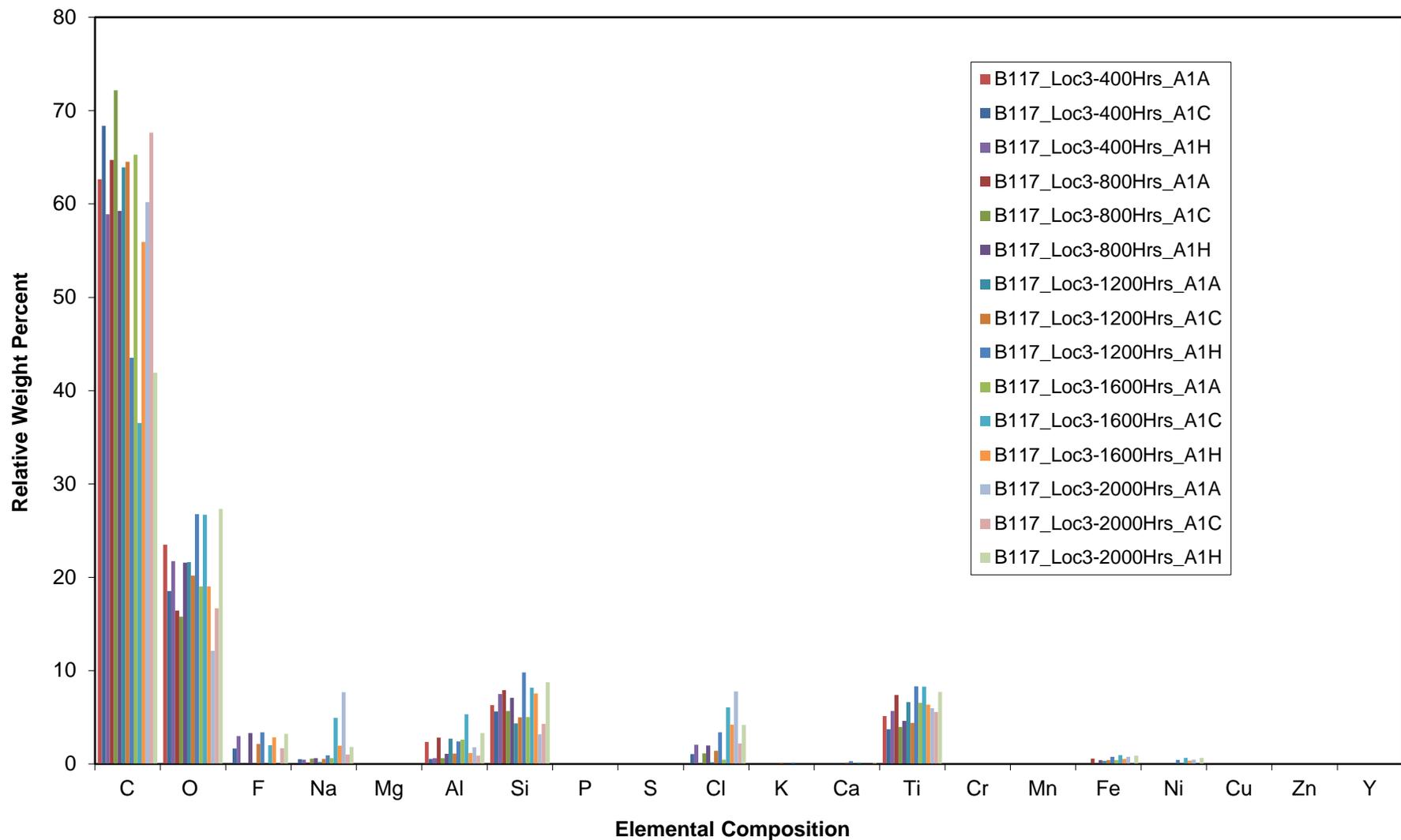


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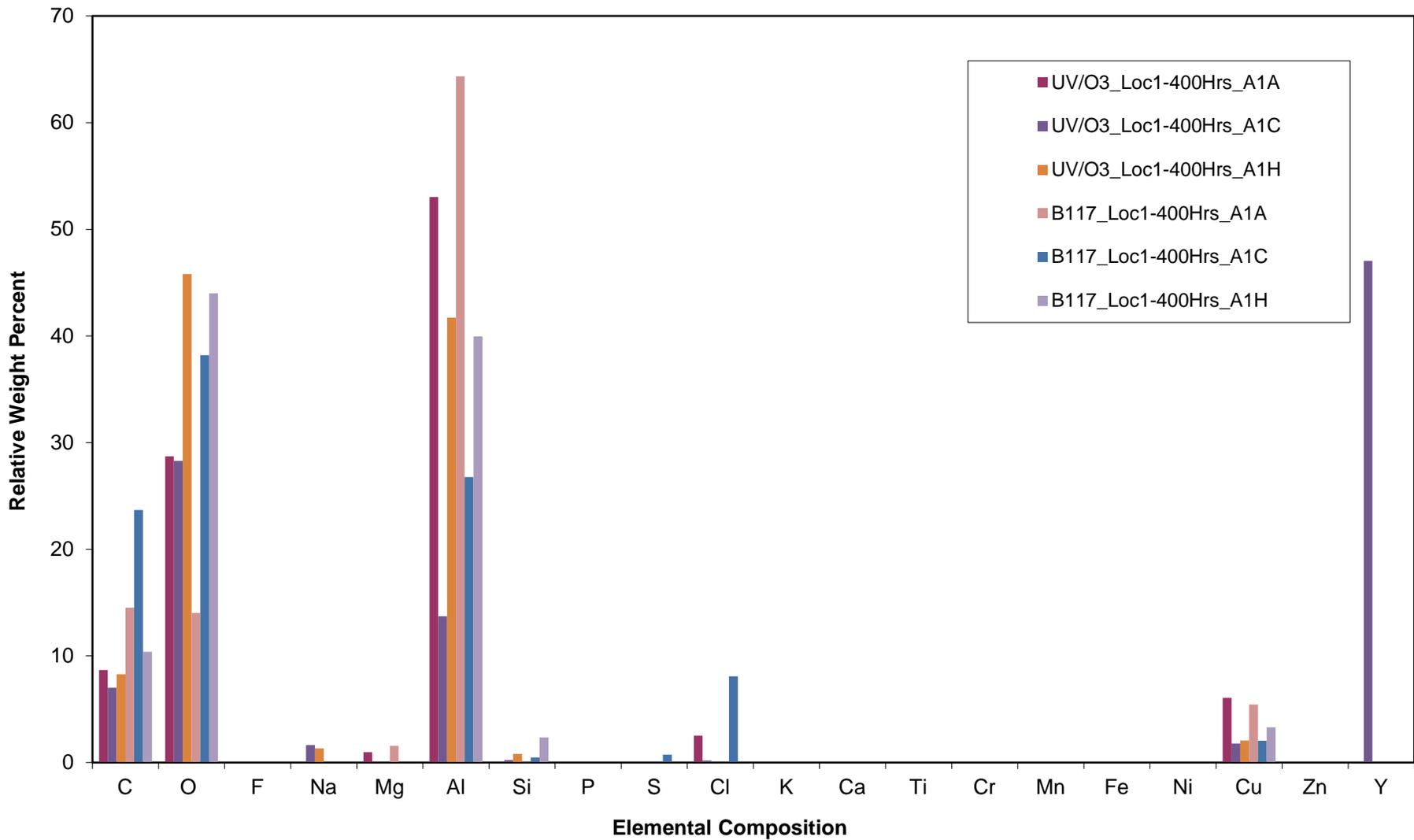


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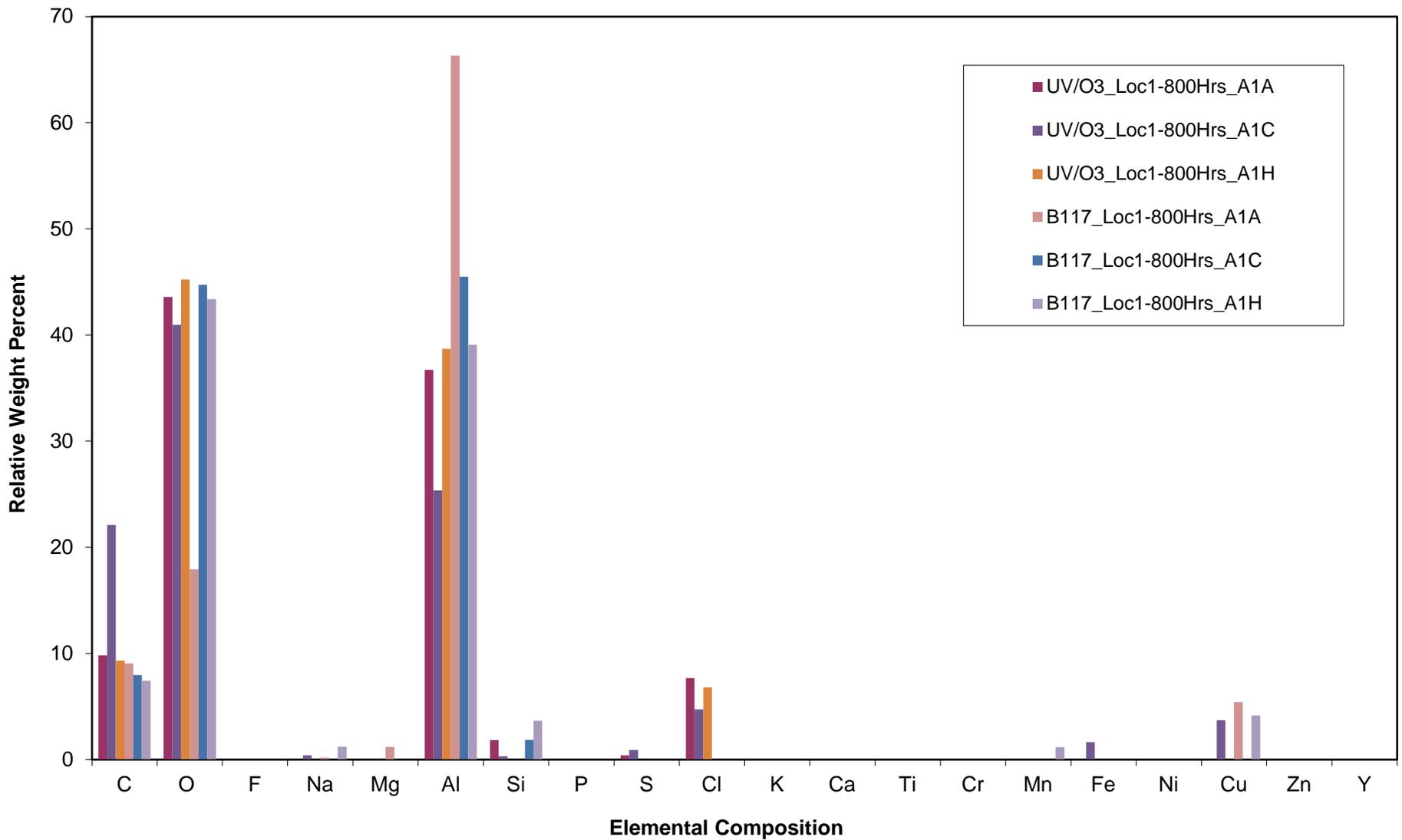


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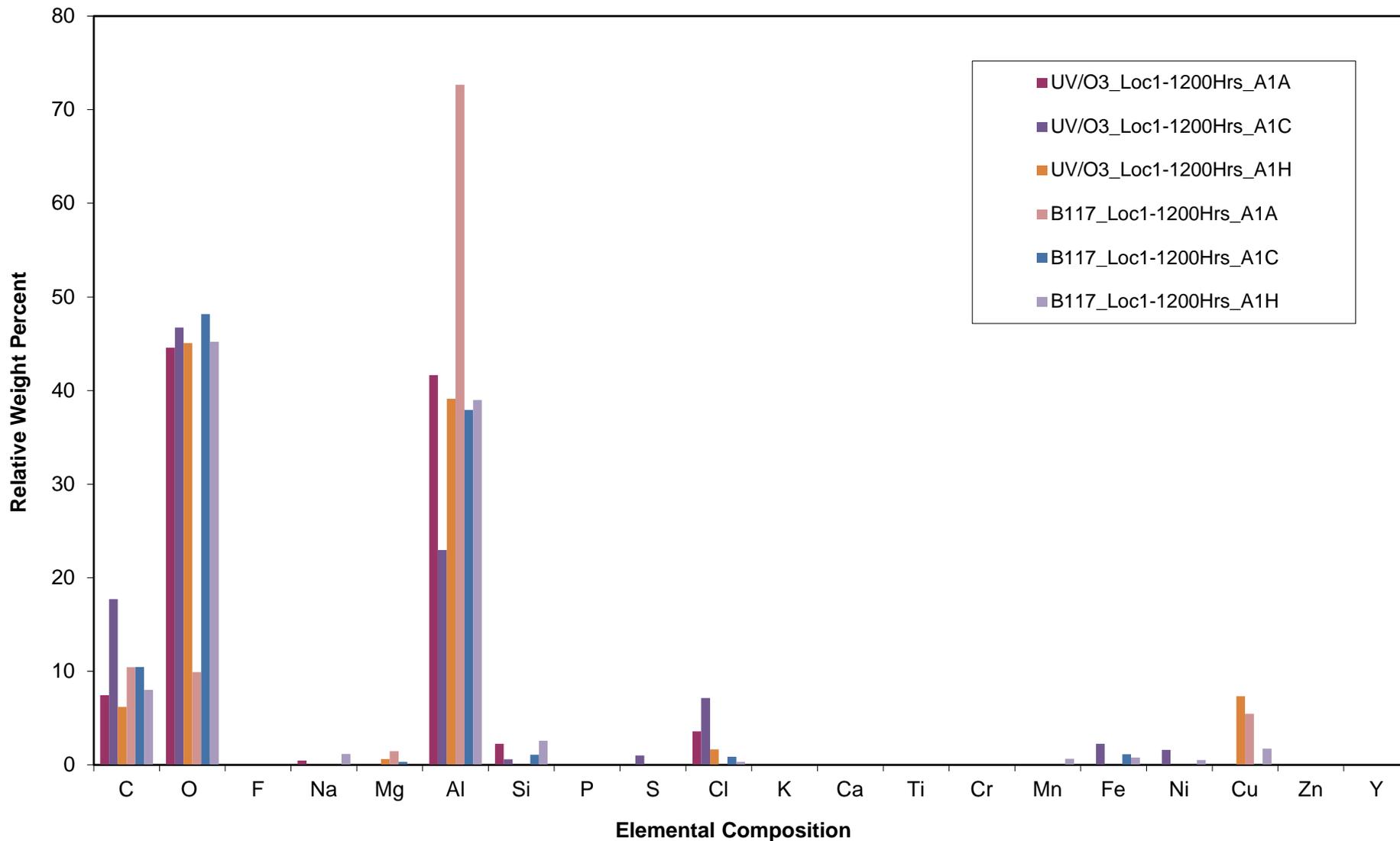


Figure S-7. Comparison of EDS of 2024-T3 coated panels at location 1 for the three coating systems (A1A: Non-chrome Mg rich system, A1C: Rare earth conversion coat, RECC, and A1H: Full chrome system) after 1200 hours in the B117 and UV/ozone chambers

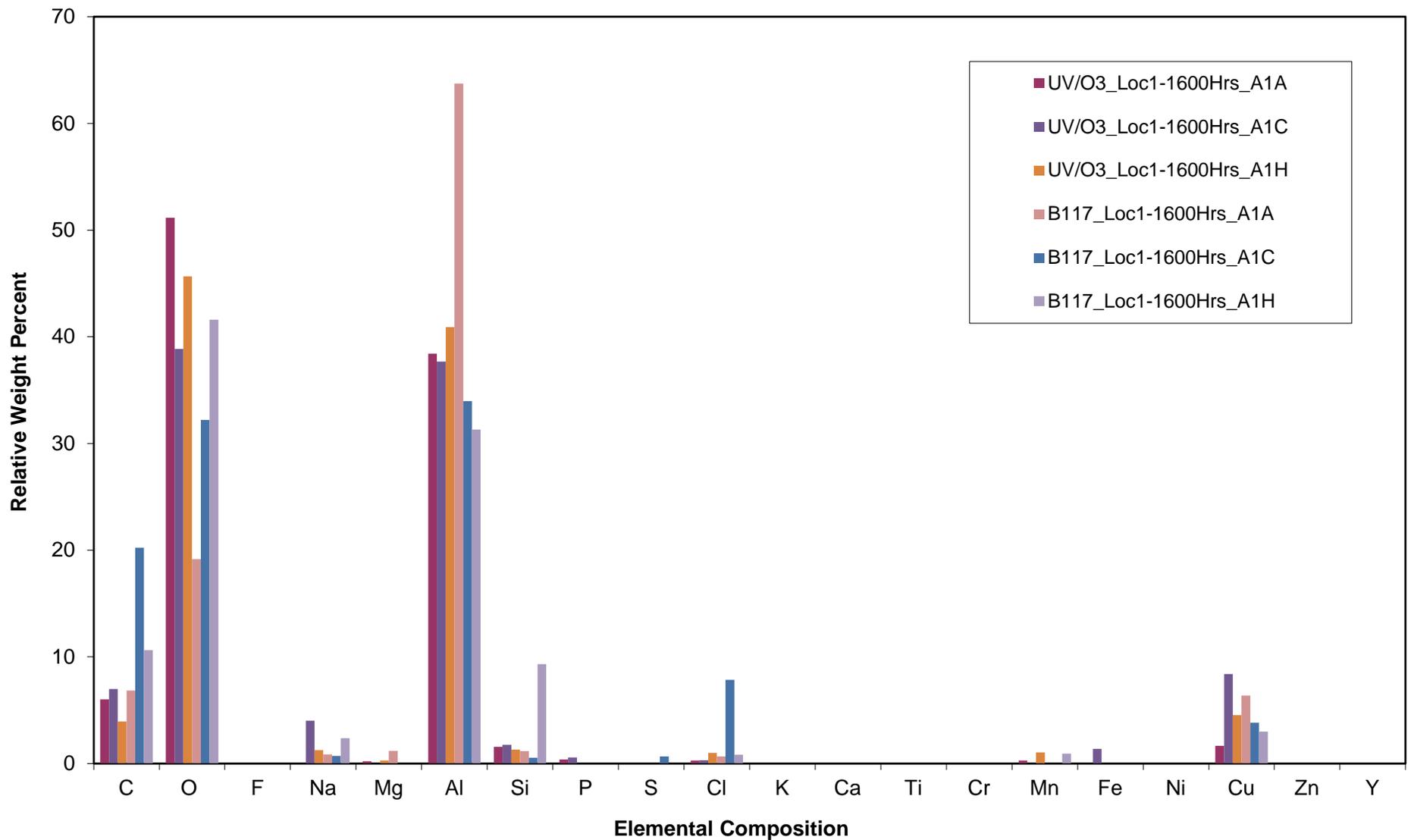


Figure S-8. Comparison of EDS of 2024-T3 coated panels at location 1 for the three coating systems (A1A: Non-chrome Mg rich system, A1C: Rare earth conversion coat, RECC, and A1H: Full chrome system) after 1600 hours in the B117 and UV/ozone chambers

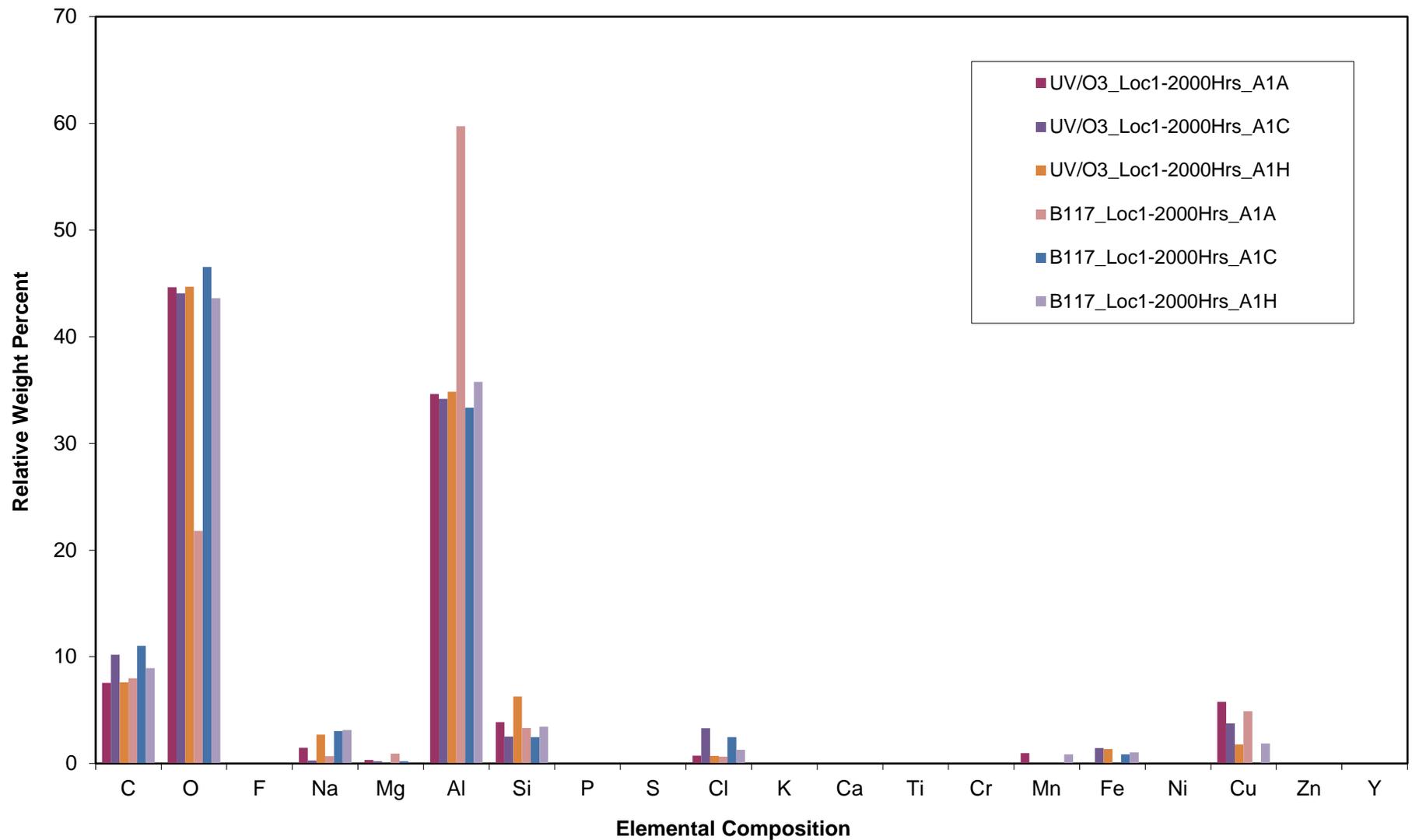


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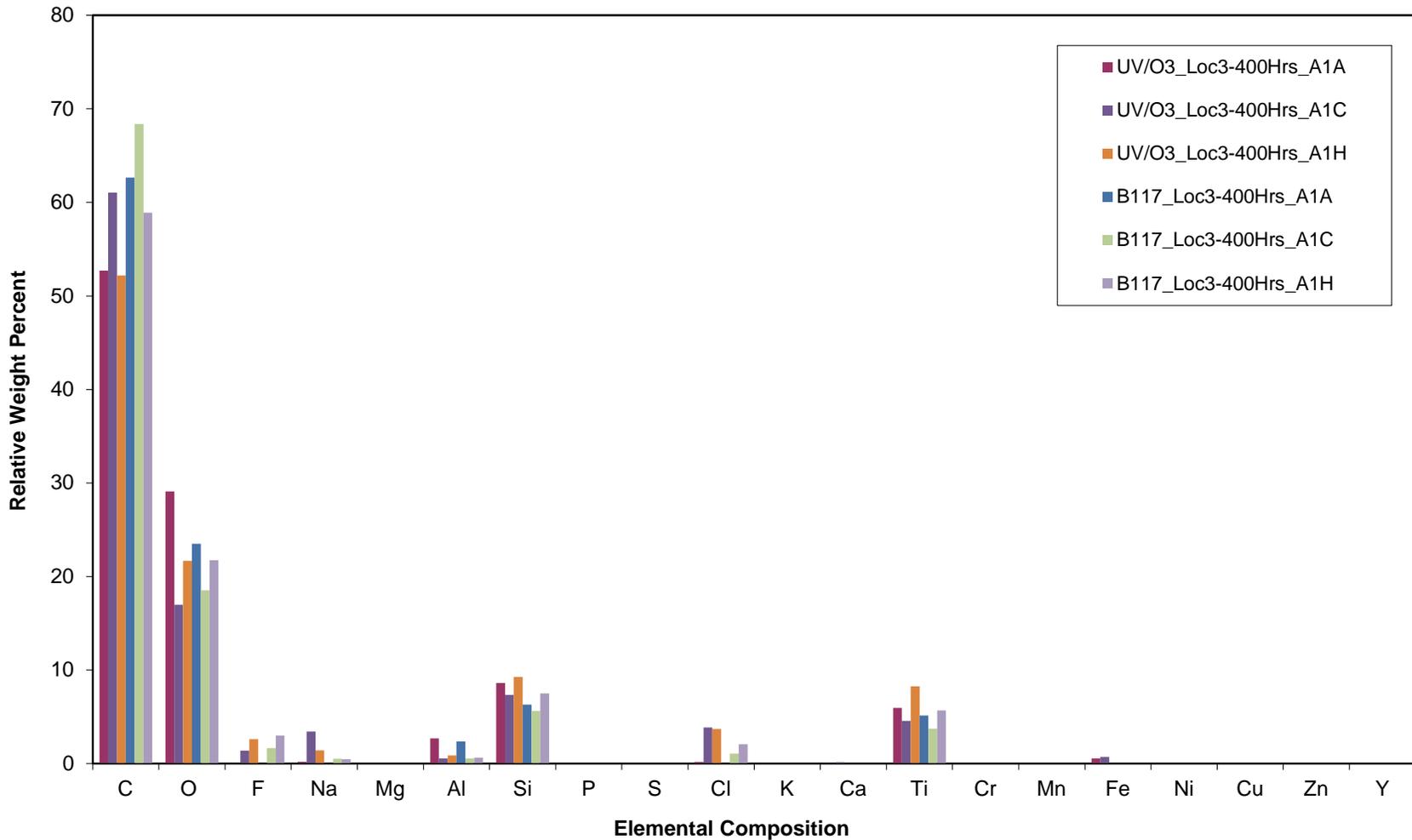


Figure S-10. Comparison of EDS of 2024-T3 coated panels at location 3 for the three coating systems (A1A: Non-chrome Mg rich system, A1C: Rare earth conversion coat, RECC, and A1H: Full chrome system) after 400 hours in the B117 and UV/ozone chamber.

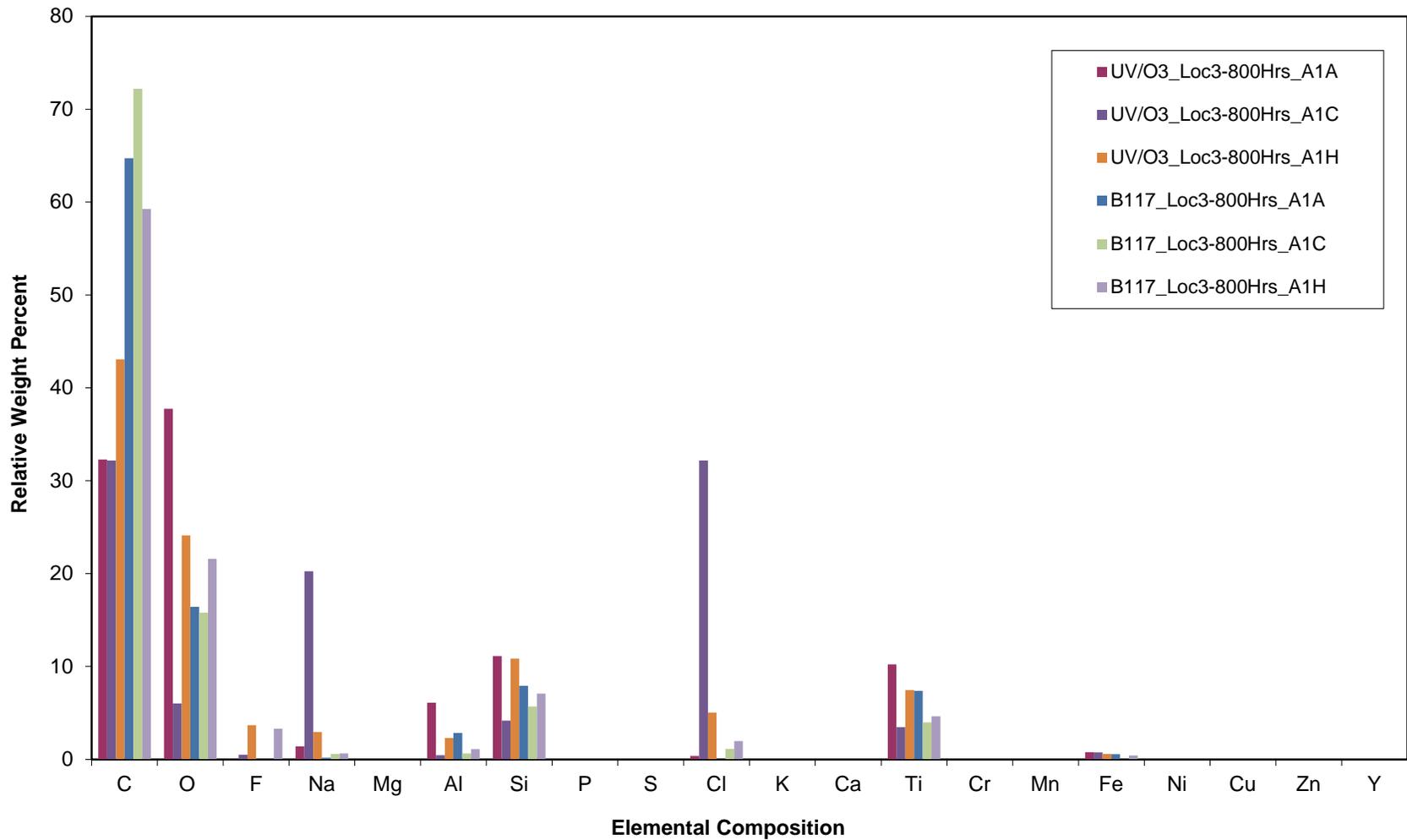


Figure S-11. Comparison of EDS of 2024-T3 coated panels at location 3 for the three coating systems (A1A: Non-chrome Mg rich system, A1C: Rare earth conversion coat, RECC, and A1H: Full chrome system) after 800 hours in the B117 and UV/ozone chamber.

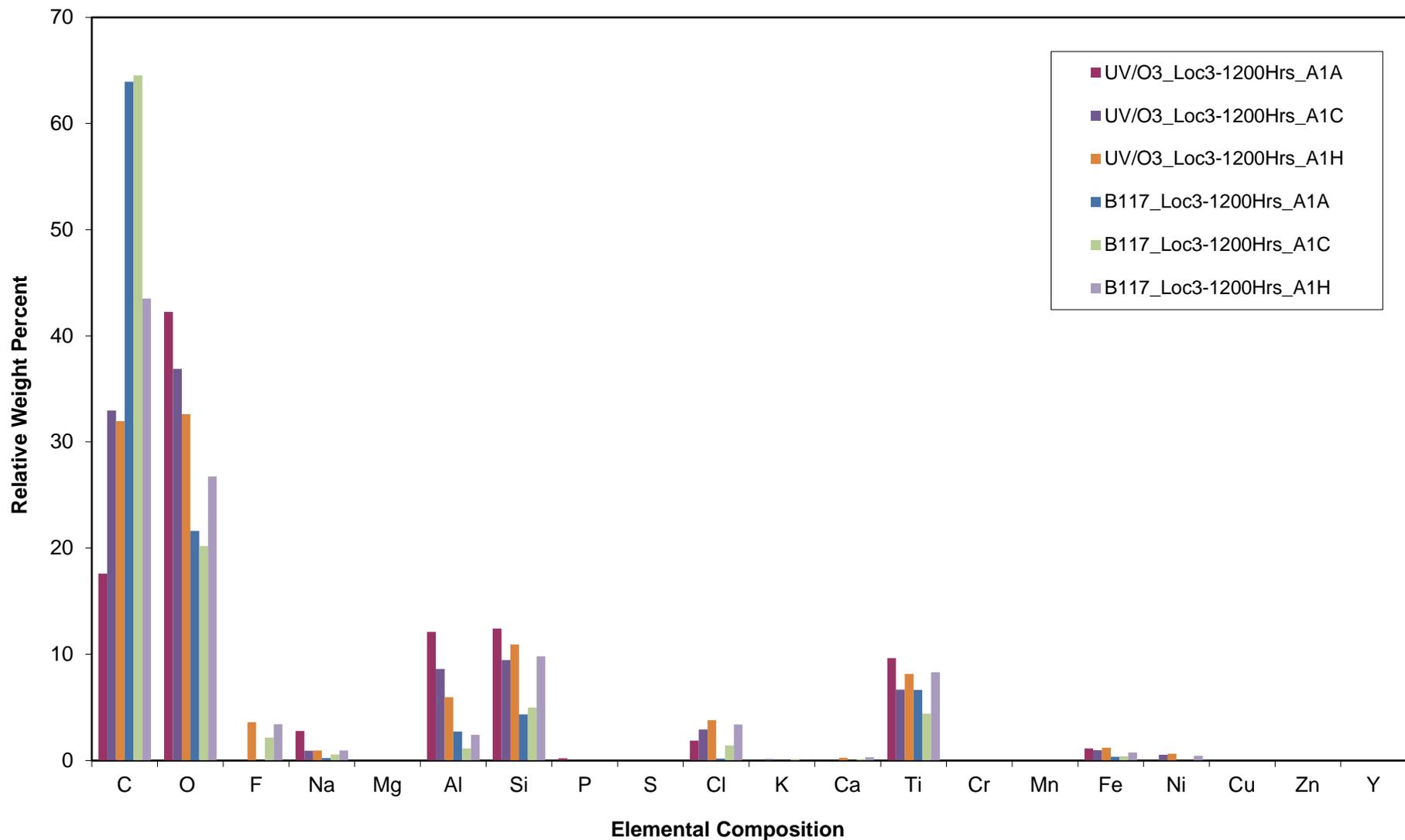


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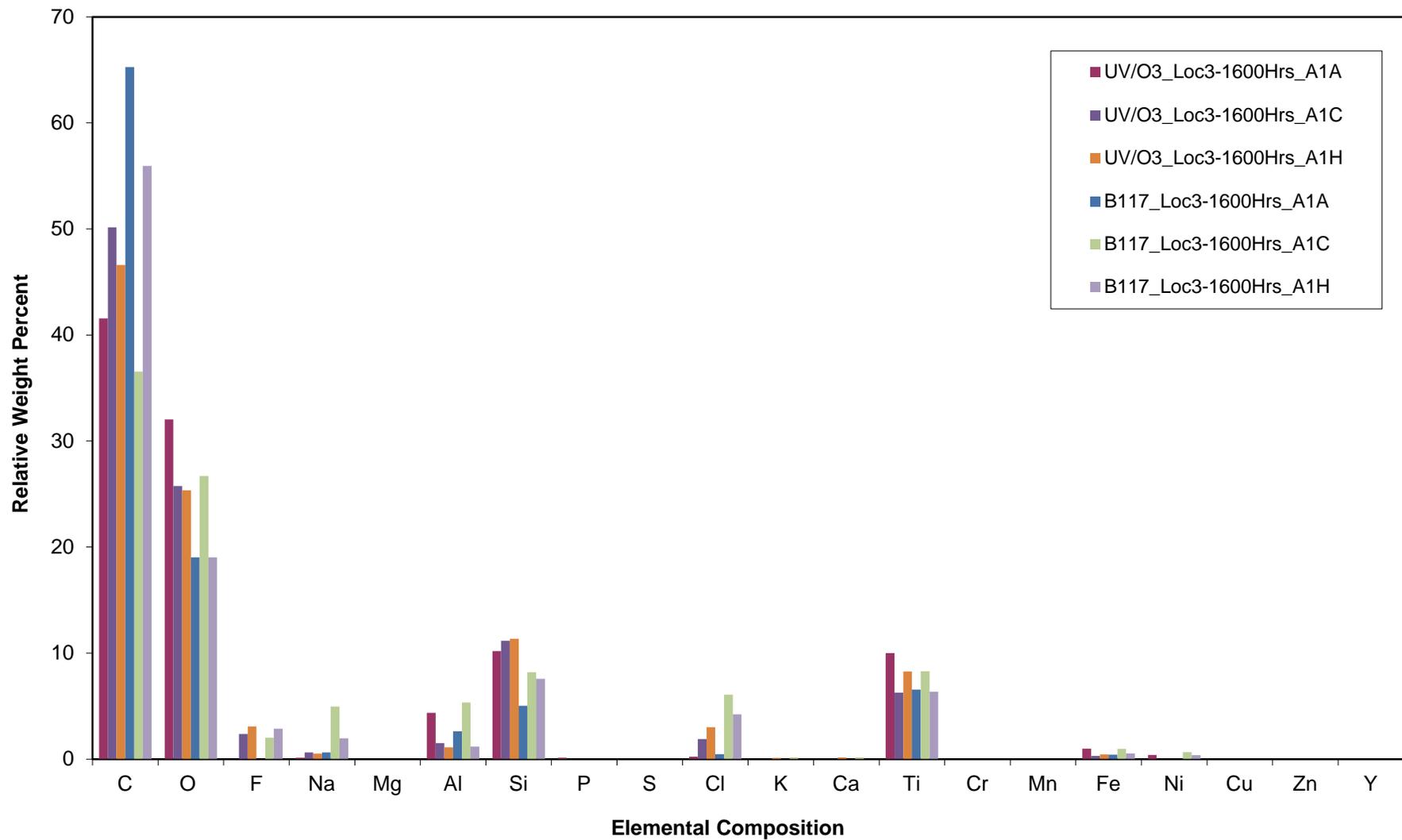


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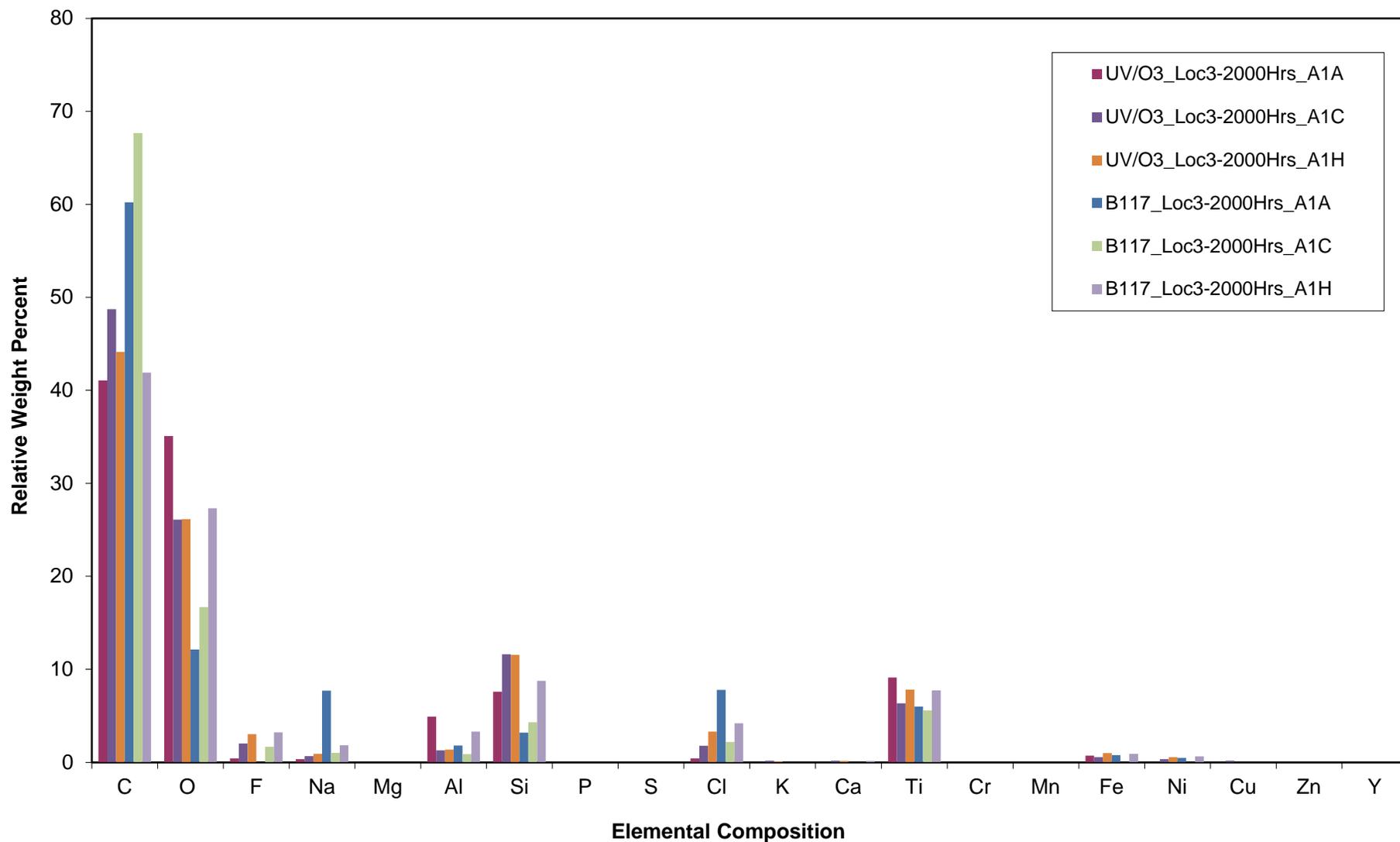


Figure S-14. Comparison of EDS of 2024-T3 coated panels at location 3 for the three coating systems (A1A: Non-chrome Mg rich system, A1C: Rare earth conversion coat, RECC, and A1H: Full chrome system) after 2000 hours in the B117 and UV/ozone chamber.

# Appendix T

## List of Scientific/Technical Publications

### 1. Articles in peer-reviewed Journals

#### a. Submitted for publication:

“Predicting Atmospheric Corrosion Rates of Steel Using a Cumulative Damage Approach. Part I: Model Development,” D. H. Rose, S. J. McCombie and D.C. Hansen, *submitted to Corrosion Journal*;

“Predicting Atmospheric Corrosion Rates of Steel Using a Cumulative Damage Approach. Part II: Simulation-Based Approach to Creating a 1010 Steel Corrosion Model,” D. H. Rose, S. J. McCombie and D.C. Hansen, *submitted to Corrosion Journal*.

#### b. In process of being submitted:

“Two Year Atmospheric Corrosion of Aluminum Alloys and Carbon Steel in Comparison to Accelerated Corrosion Chamber Tests,” Y. Yoon, J.D. Angel, W. H. Abbott, L. Petry and D.C. Hansen, *to be submitted to Corrosion Science*.

“The Effects of Environmental Parameters on the Atmospheric Corrosion of Silver: Comparison to Standard and Modified Accelerated Corrosion Chamber Tests,” Y. Yoon, L. Petry, W.H. Abbott, J.D. Angel and D.C. Hansen, *to be submitted to the Journal of The Electrochemical Society*.

“The Degradation of Epoxy Coated 2024-T3 Aluminum Alloy after Exposure to an Accelerated Atmospheric Corrosion Chamber with UV and Ozone,” D.C. Hansen, J.D. Angel, W.J. Culhane, S.A. Hayes and Y. Yoon, *to be submitted to Corrosion Journal*.

### 2. Conference or Symposium Proceedings

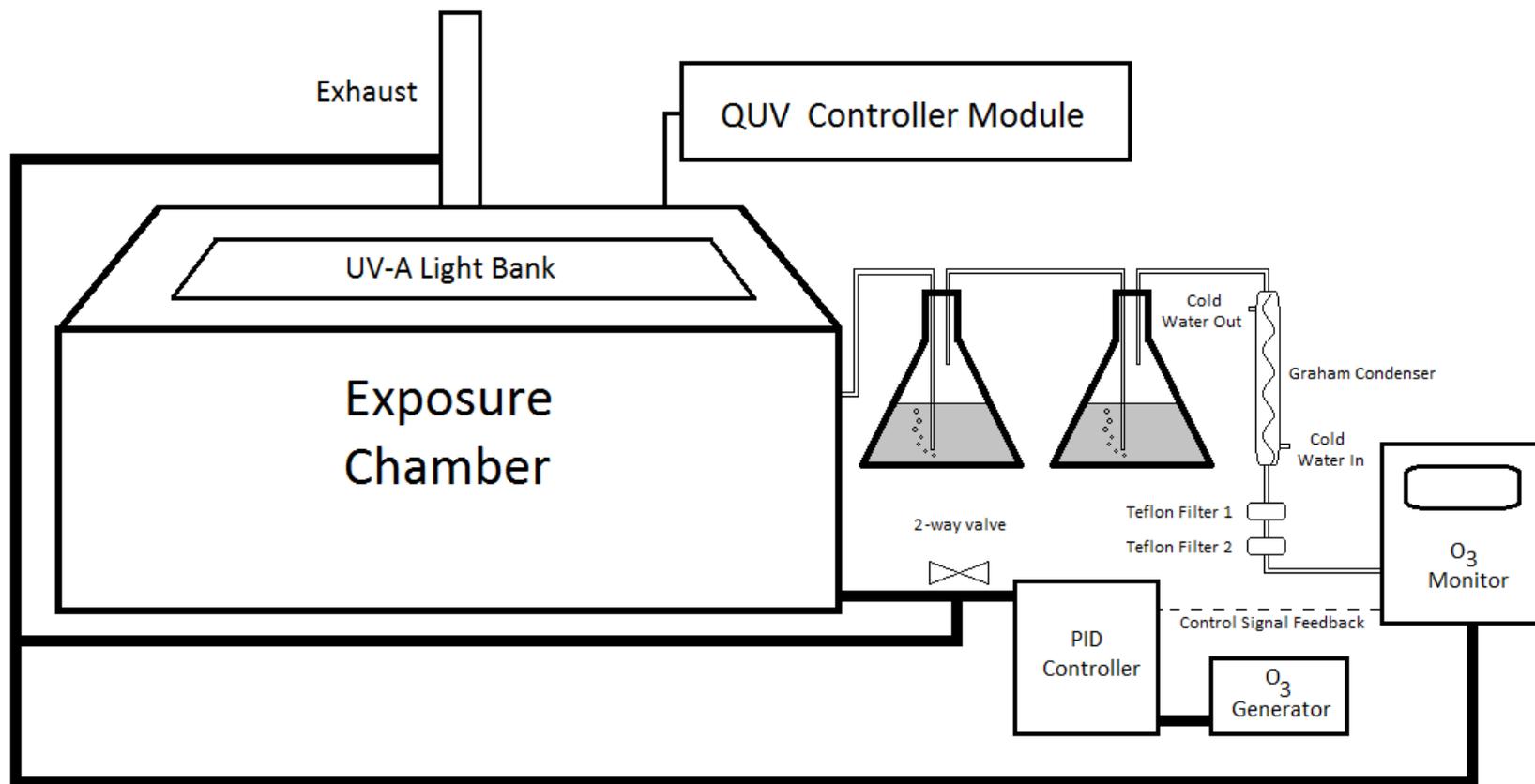
a. “The Effects of Environmental and Climatic Factors on the Atmospheric Corrosion of Silver,” Y. Yoon, D.C. Hansen, L. Petry, W.J. Culhane, C.A. Joseph, J.D. Angel and W.H. Abbott, *DoD Corrosion Conference, September 2013*.

b. “Influence of UV and Ozone Aging Compared to Atmospheric Corrosion of Epoxy Coated 2024-T3 Aluminum Alloy,” L. Petry, D.C. Hansen, C. A. Joseph, S.A. Hayes, W. J. Culhane, Y. Yoon and J.D. Angel, *DoD Corrosion Conference, September 2013*.

- c. "The Role of Environmental Aspects and Atmospheric Contaminants on the Corrosion of Aluminum Alloys," D.C. Hansen, J. Angel, L. Petry and Y. Yoon, *DoD Corrosion Conference, September 2013*.
  - d. "A Cumulative Damage Approach to Predicting the Atmospheric Corrosion Rate of 1010 Steel," D. H. Rose, S. J. McCombie, J.D. Angel and D.C. Hansen, *DoD Corrosion Conference, September 2013*.
  - e. "Development of a Dynamic Multivariate Accelerated Corrosion Test," J. Angel and D.C. Hansen, *DoD Corrosion Conference, Palm Springs, CA, August 2011*.
3. Conference or Symposium Abstracts
- a. "Comparison of Atmospheric Parameters on the Corrosion of Epoxy Coated 2024-T3 Al Alloy," L. Petry, D.C. Hansen, S. A. Hayes, Y. Yoon and J. Angel, Atmospheric Corrosion Symposium, Fall Meeting of The Electrochemical Society, San Francisco, USA, October 2013.
  - a. "Evaluation of Atmospheric Corrosion of Bare Metals During a Two Year Outdoor Exposure," Y. Yoon, D. C. Hansen, J. Angel, W. H. Abbott, W. Culhane, L. Petry and C. Joseph, Atmospheric Corrosion Symposium, Fall Meeting of The Electrochemical Society, San Francisco, USA, October 2013.
  - b. "Predicting Atmospheric Corrosion Rates for 1010 Steel using a Cumulative Damage Approach," D. H. Rose, S. J. McCombie, J. D. Angel, and D. C. Hansen, Fall Meeting of The Electrochemical Society, San Francisco, USA, October 2013.

# **Appendix U**

## **Dynamic Multivariate Accelerated Corrosion Test Protocol**



**Figure 1.** Schematic of modified Q-Fog chamber for inclusion of UV-A and ozone.

## Scope

This document covers the apparatus, equipment, procedure and conditions to provide an exposure environment containing a salt spray (fog) which includes ultra-violet (UV) and ozone (O<sub>3</sub>) conditions at various concentrations.

This protocol does not direct or define the type of test specimen or exposure period to be used for a specific substrate or coating system.

This protocol does not address all safety issues associated with the operation of UV or ozone generating equipment. It is the responsibility of the user of this protocol to establish safe operating practices and abide by any and all regulatory limitations and applications.

## Apparatus

The apparatus required for this test protocol consists of:

1. QUV Weathering Tester (Model QUV/se)
2. 4 – illumination fixtures holding UV-A bulbs
3. Teledyne Ozone Monitor (Model 456L)
4. QFog Chamber (Model CCT600)
5. Ozone Generator (Pacific Ozone, LAB11)
6. PID Controller (Love Controls Series 2600)
7. 2 – water bubble traps
8. Graham condenser

A schematic diagram of the modified system with the components is presented in Figure 1. A fog chamber and a solution reservoir (similar to that describe in ASTM B-117 standard), an ozone generator, a UV illumination controller (QUV weathering test controller), 4 sets of UV illumination bulb racks, a programmable proportional-integral-derivative controller, bubble traps, Graham condenser and Teflon filter membranes were arranged for optimal control of ozone levels in the chamber through a feedback loop system.

The ozone level is monitored within the chamber by a positive flow from the chamber into the ozone monitor through 2 successive water traps to capture dissolved salt in the gas flow; it is then cooled and condensed through a Graham condenser before flowing through 2 in-line Teflon membrane filters to trap any salt particles. The ozone level is monitored according to a pre-set value established by the operating condition requirements. The PID controller controls a 2-way valve to allow for precise control of the ozone concentration of the flow gas into the chamber; flow of the gas is diverted to the exhaust stack if the level of ozone is at

the pre-set concentration in the gas flow (valve closed). If the level is below the pre-set value, the 2-way valve will redirect the ozone into the chamber (valve open).

The QUV controller module is contained within the QUV weather tester component and controls 4 illumination fixtures (2 bulbs/fixture) for a total of 8 bulbs mounted on the exterior of the chamber lid (2 fixtures on front of lid, 2 fixtures on back of lid). Quartz windows installed in the lid will allow for minimal interference of the UV-A wavelength energy. Bulb energy and wavelength settings can be chosen to meet energy requirements for exposure conditions.

### Test specimens

The type and number of test specimens will be defined by the user, as well as the specifications covering the material or product being tested.

### Preparation of Test Specimens

*Bare coupons:* Coupon specimens will be cleaned as per ASTM G1. Mass determinations will be performed as per ASTM G1. Bare coupons may be mounted on exposure cards with plastic stand-offs as described in Figure 2.



**Figure 2.** Bare coupon exposure card example with plastic mounting stand-offs.

Specimens/exposure cards will be supported or suspended between 45° to 60° from the vertical and parallel to the flow of fog in the chamber to minimize “shadow” effects from adjacent specimens. Specimens should not come in contact with each other or any material capable of acting as a wick. The samples should be spaced so that complete exposure to the fog and chamber atmosphere is unimpeded and one sample will not drip onto another sample.

*Coated samples:* coated panels will be arranged in chamber so as not to impede exposure of adjacent sample panels to the fog spray or chamber atmosphere, and aligned in the chamber similarly to that of the bare coupons as described above.

### Spray solution

The spray solution will consist of 5 parts by mass of sodium chloride as per ASTM B117.

### Continuity and Period of Exposure

Unless otherwise specified in the test conditions for the material being tested, the test exposure period will be for 100 hour cycles. Samples will be exposed in continuous spray conditions with ozone and UV exposure at pre-set values. Typically, this is accomplished by running the exposure in a Monday morning-Friday afternoon format, with the samples being held in the chamber over the weekend in a passive exhaust condition, with the illumination, spray and ozone flow turned off. During the down time, maintenance may be performed on the ozone gas flow lines, controller, bubble traps, filters, etc. Samples are typically removed on Monday morning for inspection prior to the start-up of the system for the next 100 hour exposure.

### Cleaning of Tested/Exposed Sample Specimens

The samples will be carefully removed from the chamber and washed in deionized or distilled water to remove any salt deposits from their surface and immediately dried.

### Mass Determinations of Exposed Bare Specimens

Coupon specimens will be cleaned as per ASTM G1. Mass determinations will be performed as per ASTM G1.

Mass loss/gain will be reported as micrograms per square centimeter ( $\mu\text{g}/\text{cm}^2$ ). Corrosion rate will be reported as mass loss per unit time of exposure (hours).

## REFERENCES CITED

1. ASTM G1 "Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens," ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.
2. ASTM B117 "Standard Practice for Operating Salt Spray (Fog) Apparatus," ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.

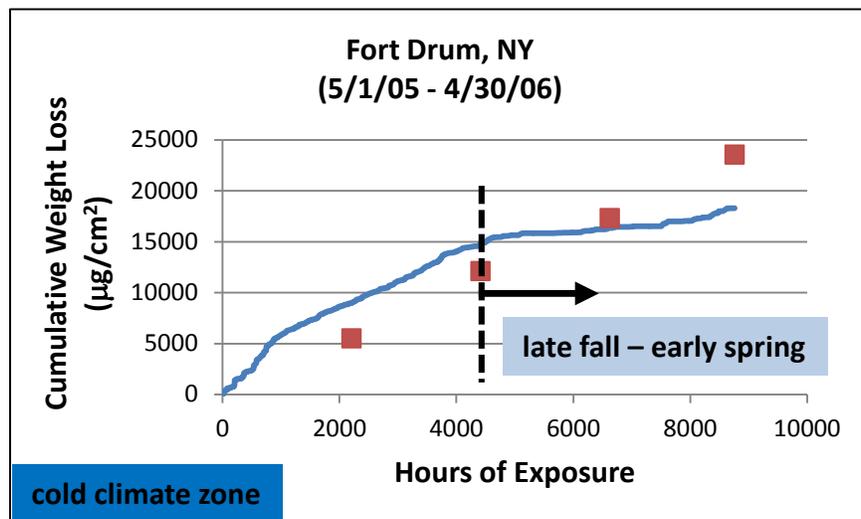
# **Appendix V**

## **Cumulative Predictions for Model Calibration and Validation Sites**

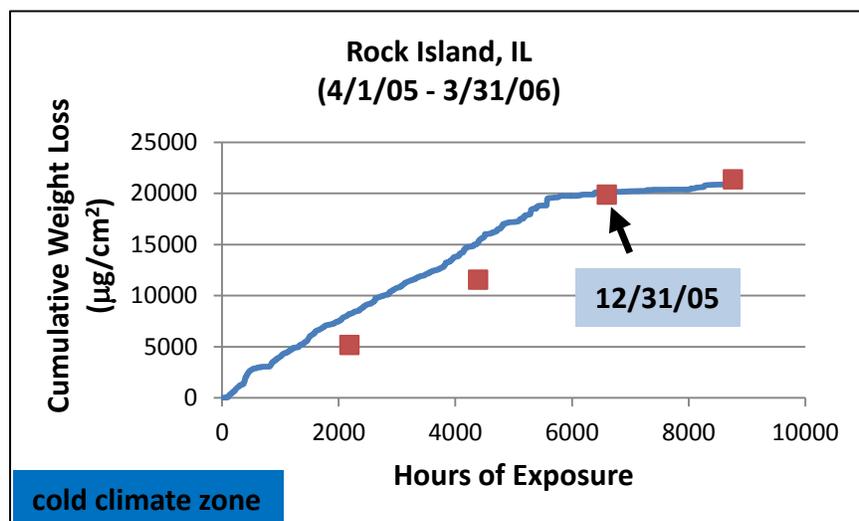
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## APPENDIX V: CUMULATIVE PREDICTIONS FOR MODEL CALIBRATION AND VALIDATION SITES

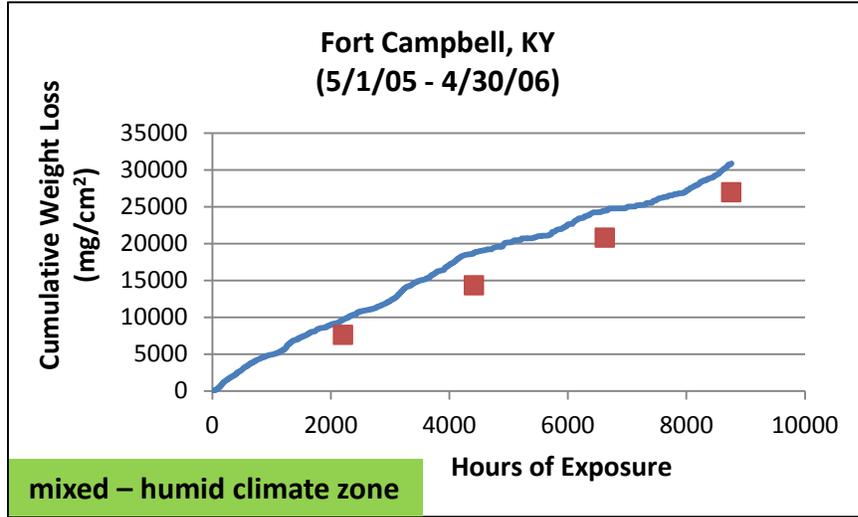


**Figure V1.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Calibration Site at Fort Drum, New York

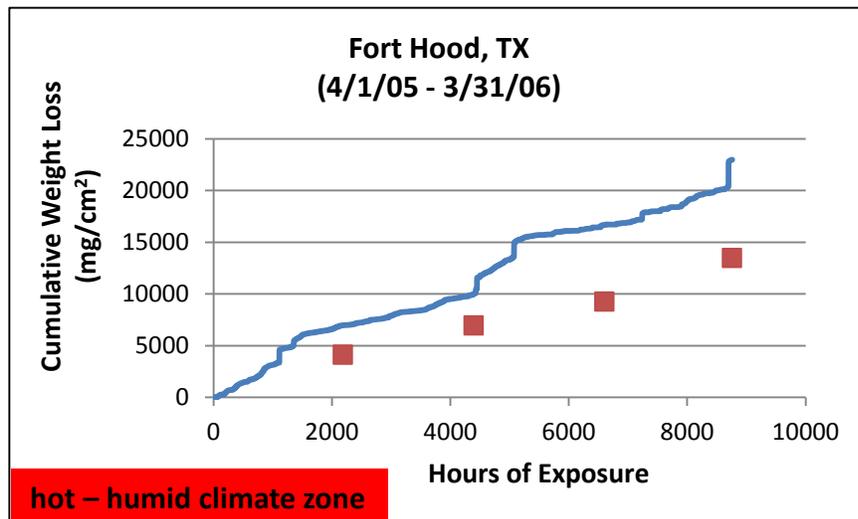


**Figure V2.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Calibration Site at Rock Island, Illinois

**Figures V1 and V2** both have a plateau in the cumulative predictions that is not seen in the test observations. As discussed earlier, this plateau could be due to the way the cumulative corrosion damage model considers low absolute humidity levels at low temperatures. Further work is needed to investigate this issue.

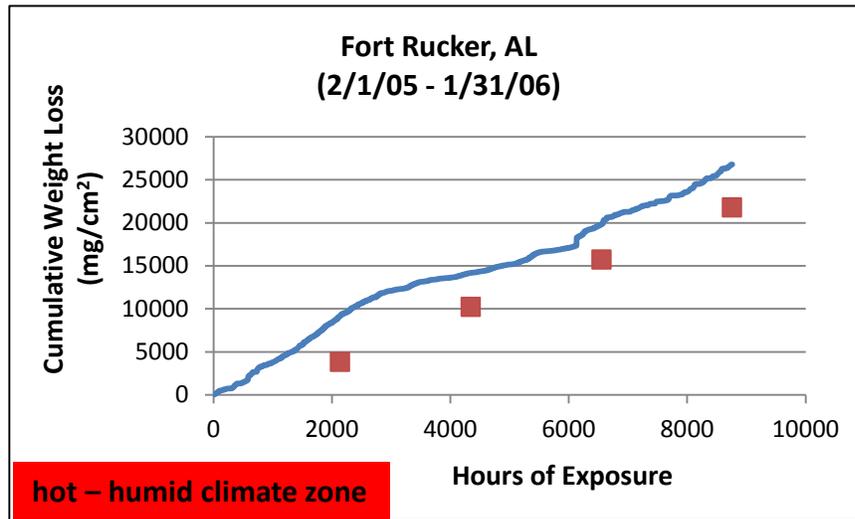


**Figure V3.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Fort Campbell, KY

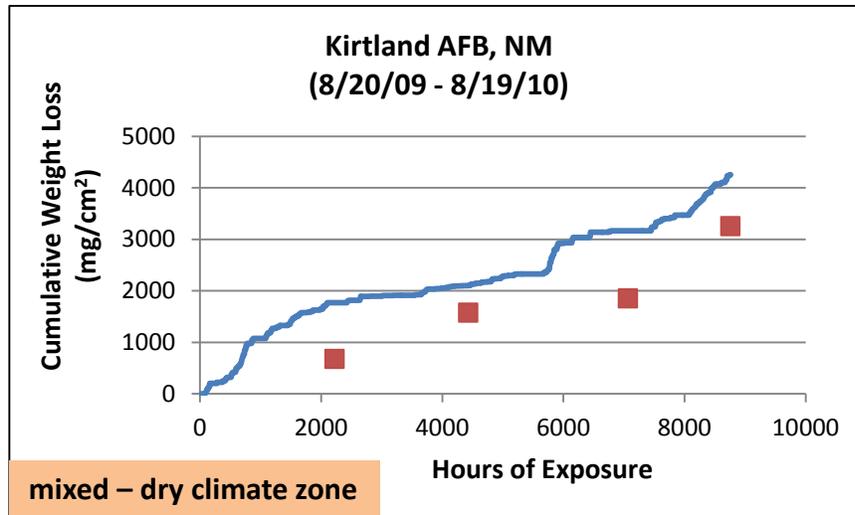


**Figure V4.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Fort Hood, Texas

The cumulative corrosion damage model applied to environmental data for Fort Campbell, Kentucky only slightly over-predicts the corrosion test data while showing the exact same general trends (see **Figure V3**). The predictions for Fort Hood, Texas exhibit several apparent step increases that are not present in the test data. An inspection of the proxy SO<sub>2</sub> data used to make the cumulative predictions revealed anomalous hourly readings that were orders of magnitude higher than adjacent hourly measurements. Such massive increases over short periods of time do not seem likely and may indicate problems with the SO<sub>2</sub> measurement equipment. Had the step increases not occurred in the SO<sub>2</sub> proxy, the predictions would have more closely tracked the test points seen on **Figure V4**.

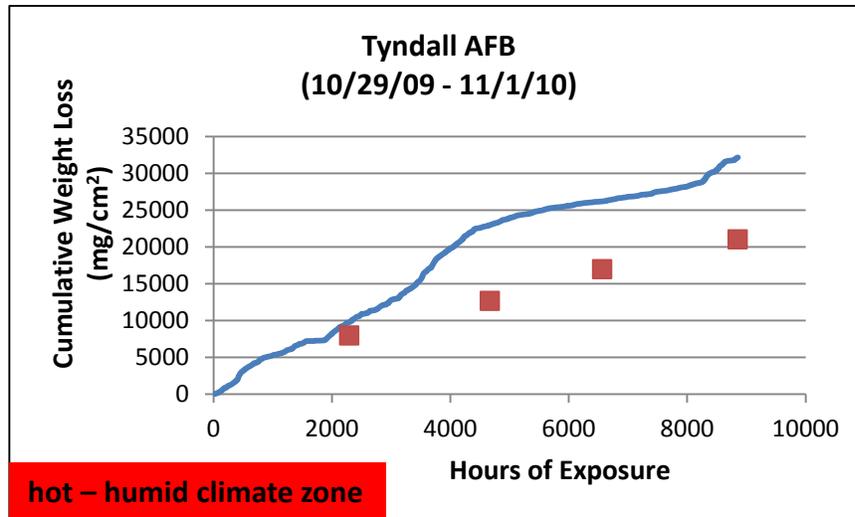


**Figure V5.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Fort Rucker, Alabama



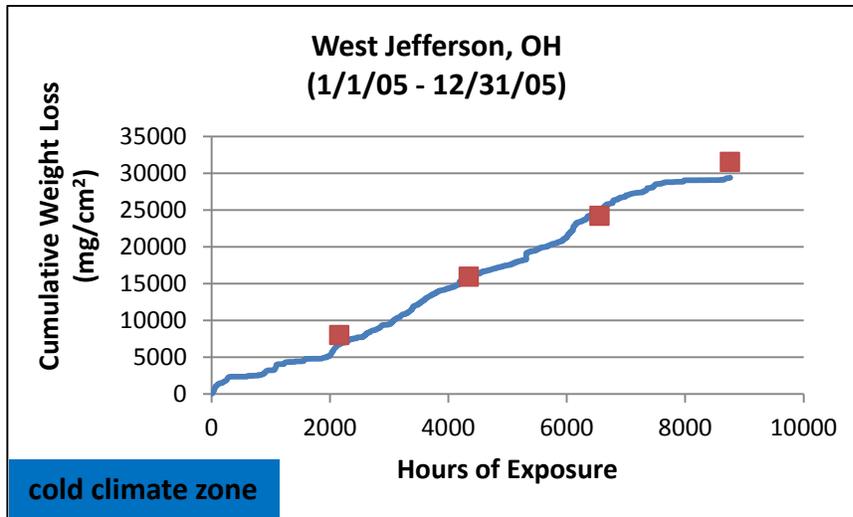
**Figure V6.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Kirtland AFB, New Mexico

The cumulative corrosion damage model applied to environmental data for Fort Rucker, Alabama also slightly over-predicts the corrosion test data while showing the exact same trends (see **Figure V5**). The model applied to proxy data for Kirtland AFB, NM shows slightly more disagreement with the test data (see **Figure V6**), which may also be due to the SO<sub>2</sub> proxy. There were few SO<sub>2</sub> measurement sites in New Mexico and the one chosen is near a coal-fired power plant located at Shiprock, which is a small city to the northwest of Kirtland AFB. The SO<sub>2</sub> levels at Shiprock may indeed be higher than those present at the corrosion test site and thus contributed to the predictions being higher than the test measurements.

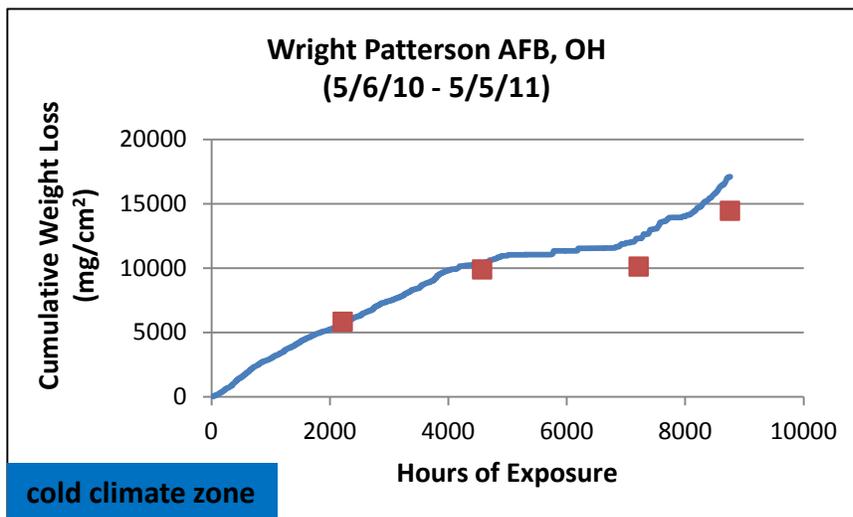


**Figure V7.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Tyndall AFB, Florida

Comparison of the test data for Tyndall AFB, Florida (**Figure V7**) with the test data for West Jefferson, Ohio (**Figure V8**) and Wright Patterson AFB (**Figure V9**) reveals a possible problem. As can be seen, the corrosion rates for Tyndall AFB are lower than the rates for West Jefferson and only slightly higher than the rates for Wright Patterson AFB. Since Tyndall AFB is in the hot-humid climate zone and the test site was located very close to the coastline, it seems likely that the corrosion rates would be higher than those measured at both Ohio locations, which are in the cold climate zone and hundreds of miles from the coast. The fact that they are not higher than the Ohio rates may indicate that the wrong test data for this location was recorded in the corrosion rate database. **Figures V8 and V9** show good agreement with their respective test data. In both cases, the cumulative predictions and their trends follow closely with the test measurements made at the same validation sites.



**Figure V8.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at West Jefferson, Ohio



**Figure V9.** Comparison of Cumulative Predictions with Quarterly Test Measurements for the Validation Site at Wright Patterson AFB, Ohio

## List of Acronyms

%RH	percent relative humidity
AA2024-T3	aluminum alloy 2024, T3 temper rating
AFB	Air Force Base
ASTM	American Society of Testing and Materials
ATR	attenuated total reflectance
B117	Standard Salt Fog Exposure Test
	Coatings Technology Integration
CTIO	Office
DoD	Department of Defense
EDAX	energy dispersive X-ray spectroscopy
EDS	energy dispersive spectroscopy
ESEM	environmental scanning electron microscope
FT-IR	Fourier transform infra-red spectroscopy
HAP	hazardous air pollutant
MRP	Magnesium rich primer
PID	proportional integral drive
RECC	Rare Earth Conversion Coat
SEM	scanning electron microscope
UV-A	ultraviolet radiation, 315 – 380 nm wavelength
VOC	volatile organic component
WPAFB	Wright-Patterson Air Force Base