Non-Isocyanate Polymer Design & Coating Development

SERDP WP-2315

THE PROBLEM

Develop a high performing exterior topcoat without the use of isocyanate crosslinkers

THE BENEFIT

Significantly reduce the exposure of painters to health hazards.

THE APPROACH

Crosslinking Chemistry	Advantages	Disadvantages	Probability of Success
Cyclic carbonate	Non-isocyanate method of producing urethanes	Prior work used force-dry conditions	Highest technical risk
Poly-uretidione	Prior work identified effective catalyst for RT cure	High viscosity	Viable cure demonstrated – moderate risk
Polysiloxane	Hard, durable chemistry	Flexibility; cure response	Commercial technology – lowest risk

THE PERSONNEL

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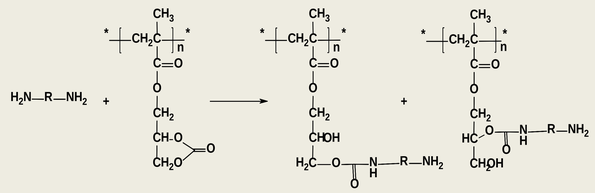
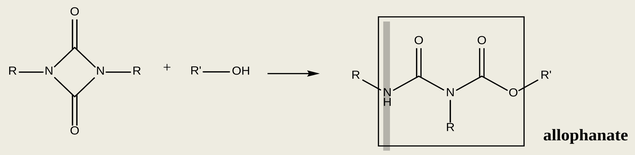
RESULTS

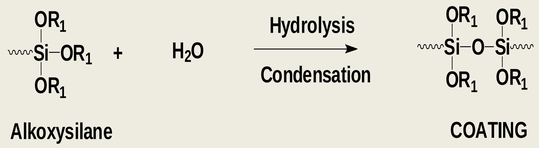
Cyclic Carbonate



Polyuretidione



Polysiloxane



Cyclic Carbonate-Amine Summary

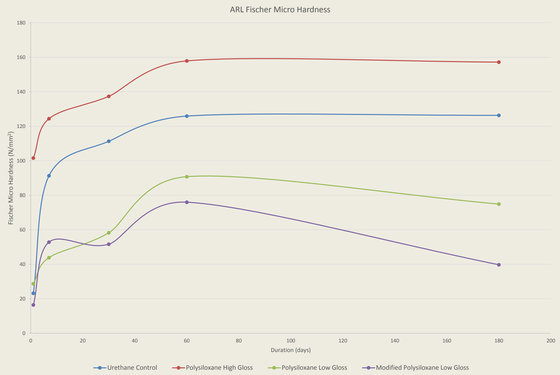
- Achieving solvent resistance within 24 hours of room temperature cure is difficult.
- Formulations that did reach 100 MEK double rubs at room temperature had low hardness.
- Curing at temperatures of 200°F did generate films with acceptable solvent resistance and hardness.
- Energy calculations are consistent with the results of the investigation.

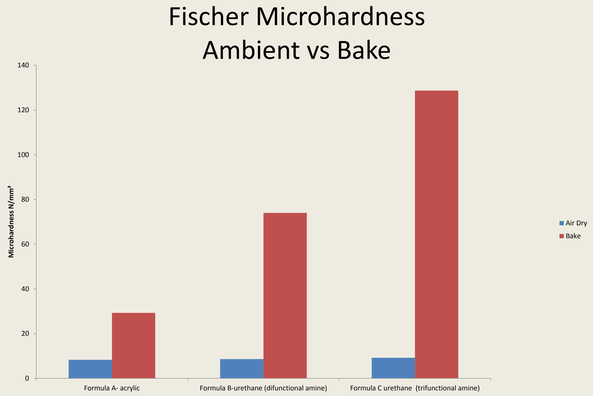
Polyuretidione Summary

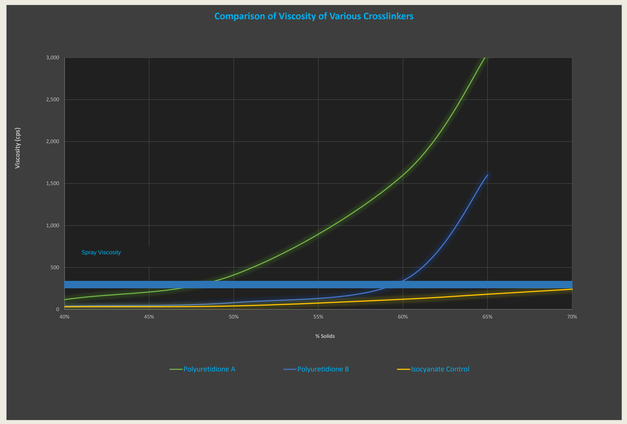
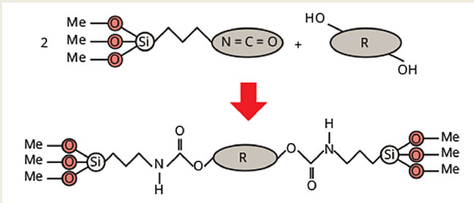
- Cure response at room temperature, adhesion, flexibility and appearance were all acceptable.
- Adequate pot life was achieved without affecting room temperature cure by blocking the amine catalysts with volatile acids
- The solids at spray viscosity and film hardness of the best prototypes were below standard commercial coatings

Polysiloxane Summary

- Excellent room temperature hardness but slow dry times
- Poor flexibility
- Low gloss capable
- Concern for post-cure hardness can be managed







- Commercially available alkoxy silane functional urethanes improved flexibility but not dry time