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Agenda

1. Company Overview
2. Status on cadmium substitution
3. Difficulties in qualifying a substitute
4. Conclusion
1. Company Overview
1. Company Overview

- Founded in 1952
- Revenue 2015: 290 M€
- R&D 7 to 8% of revenue each year
- 11 Manufacturing plants in America, Asia & Europe
- 3,000 Employees

Pierre Gattaz (CEO)
1. Company Overview

**Revenue 2015**
290 Million € (+3.8%)
$321,900,000

- 47% Aerospace
- 30% Asia and the Rest of the World
- 44% America
- 25% Defense & Space
- 15% Telecom
- 13% Industrial
- 14% Rest of Europe
- 12% France

10% average growth since 2009
1. Company Overview

- Obregon, Mexico
- New Haven, USA
- Shanghai, China
- Bangalore, India
- Milan, Italy (Van System)
- Mendrisio, Switzerland (Van System)
- Château-Renault, France
  - Centr’Alp, France
  - Dole, France (IDMM)
  - L'Isle-d'Abeau, France
  - Voiron, France (Raydiall)

11 PLANTS WITH OVER 3,000 EMPLOYEES WORLDWIDE
1. Company Overview

- Optical Connectors
- Optical Cable Assemblies
- Active Optics
- Outdoor Connectors
- RF Coaxial Connectors
- RF Cable Assemblies
- Multipin Aerospace Connectors
- Multipin Industrial Connectors
- RF & Microwave Switches
- Microwave Components
- Antennas
- Space Qualified Components
2. Cadmium substitution study
### Impact of REACH on Cadmium plating

#### Registered substances
- **14817 subs**
- All chemical substances imported or produced in the EU

#### Evaluation substances
- **319 substances**
- RMOAs: **61 substances**
- SVHC substances: **169 substances**

#### Legal obligation for user
- Inform SVHC presence above 0.1%.

#### Substances under authorisation
- **31 substances**
- Prohibition of use in processes in the EU from a sunset date:
  - **Planned obsolescence**

#### Cadmium
- EC no.: 231-152-8
- CAS no.: 7440-43-9
- Date of inclusion: 20/06/2013
- Reason for inclusion: Carcinogenic (Article 57a)
- Decision: ED/69/2013

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<th>Name</th>
<th>EC no.</th>
<th>CAS no.</th>
<th>Entry no.</th>
<th>Sunset Date</th>
<th>Latest application date</th>
<th>Exempted uses (categories of)</th>
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</tbody>
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2. Radiall substitution study

- Cadmium+HCP applied on different connector families. Induced different mating strengths, shapes, contact areas...

- Evaluation of new developments realized on aluminium panels to avoid impact of these factors + faster procurement

- First filter: Salt spray performance (ASTM B117) Contact electrical resistance (MIL-DTL-81706)
2. Radiall substitution study

Status on evaluations:

- **ZnNi + Cr III / Co**
- **ZnNi + Cr III / Zr**
- **ZnNi + Cr free**
  - Cerium / Permolybdate/
- **Other alloys**
  - ZnFe / SnZn / …

Low TRL of technologies without Cobalt

- Difficulty to get dark passivates
- High insulating effect of Zinc oxides
3. Main difficulties in qualifying a substitute
3. Difficulties in qualifying a substitute

Starting point:
Connector specifications not sufficient to determine qualification test files for plating substitution

1- Corrosion performances criteria
2- Galvanic compatibility required
3- Sacrificial corrosion criteria
4- Nonreflective criteria
3. Difficulties in qualifying a substitute

3.1 Corrosion performances criteria

Mil-Dtl-38999
(3.17.1) “When tested as specified in 4.5.13, unmated connectors shall show **no lifting of plating or exposure of basis material** […]”

Evaluation of compatibility between ENPTFE and Cadmium

⇒ Acceptable ?
3. Difficulties in qualifying a substitute

3.2 Galvanic compatibility of Cadmium substitute

Mil-Dtl-38999
(3.3.1.2) “Dissimilar metals and compatible couples are specified in MIL-STD-889.”

BUT:
- SnZn, ENPTFE, ZnNi, etc., not included in MIL-STD 889C
- Material in contact not always known by connector manufacturers

➔ How to qualify a plating not mentioned?
➔ Only evaluation of compatibility with cadmium?
3. Difficulties in qualifying a substitute

3.3 Sacrificial corrosion criteria

Risk of galvanic corrosion in case of coating damage on use condition

Key parameters to fix
- Load
- Scratch dimension
- Shape
- Tool
- NSS exposure

Criteria?
- Corrosion Deepness
- Number of corrosion sites

Dimensions: Width: 0.5 mm; Depth: 0.2 mm
Tool: automated milling cutter
Salt Spray: 500 hours exposure
3. Difficulties in qualifying a substitute

3.3 Nonreflective coating

Mil-Dtl-38999
(6.1.1 )“Class T, series III and IV and finish T, series I and II, is required to be nonreflective...”

- Aspect is one of the **great challenge** of cadmium substitution. Acceptance criteria should be clarified.

- Measurement of reflectance? Use of gloss-meter?
4. Conclusion
4. Conclusion

- Greater maturity of Zinc-Nickel coatings but lot of work necessary to get a global solution

- Current specifications and test sequences are not sufficient to qualify cadmium and chromate finish substitute

- Working groups for product specifications updates?
Thank you

Questions / comments?

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