GalvInfo Center

Inquiries about Construction and Appliance Applications of Zinc-Containing Coated Steel Sheet Trends and Implications

Presented at Galvatech '04
April 4-7, 2004
Chicago, Ill
GalvInfo Center

A zinc-coated steel sheet technical information center managed by ILZRO and cosponsored by the steel, paint and zinc industries.
GalvInfo Center

Objectives

- Provide technical assistance to users and potential users of zinc and zinc-alloy coated steel sheet
- Broaden the understanding of the user community about behavior and performance of coated steel sheet
- Assist with growing the markets for zinc and zinc-alloy coated steel sheet
GalvInfo Center
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- International Steel Group
- InterAmerican Zinc
- International Zinc Association
- PPG
- Steelscape
- The Techs
- USS-POSCO
<table>
<thead>
<tr>
<th>GalvInfo Center Inquiry Topics - 2003</th>
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</thead>
<tbody>
<tr>
<td><strong>Construction</strong> 83%</td>
</tr>
<tr>
<td><strong>Corrosion</strong> 47%</td>
</tr>
<tr>
<td><strong>Service Life</strong> 35%</td>
</tr>
<tr>
<td>In the atmosphere - 9%</td>
</tr>
<tr>
<td>In buildings - 8%</td>
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<tr>
<td>With treated wood - 8%</td>
</tr>
<tr>
<td>In concrete - 4%</td>
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<tr>
<td>Galvanic contact - 4%</td>
</tr>
<tr>
<td>In soil - 2%</td>
</tr>
<tr>
<td><strong>Various</strong> 12%</td>
</tr>
<tr>
<td>Storage stain - 6%</td>
</tr>
<tr>
<td>Salt spray resistance - 4%</td>
</tr>
<tr>
<td>Zinc runoff - 2%</td>
</tr>
<tr>
<td><strong>Appearance</strong> 20%</td>
</tr>
<tr>
<td>Phosphatizing - 6%</td>
</tr>
<tr>
<td>Painting issues - 6%</td>
</tr>
<tr>
<td>Dulling and others - 8%</td>
</tr>
<tr>
<td><strong>Weldability</strong> 11%</td>
</tr>
<tr>
<td>General - 5%</td>
</tr>
<tr>
<td>Galvalume - 2%</td>
</tr>
<tr>
<td>Phosphatized - 2%</td>
</tr>
<tr>
<td>To stainless - 2%</td>
</tr>
<tr>
<td><strong>General</strong> 6%</td>
</tr>
<tr>
<td>Coating thickness - 4%</td>
</tr>
<tr>
<td>Fire ratings - 2%</td>
</tr>
<tr>
<td><strong>Appliance</strong> 17%</td>
</tr>
<tr>
<td><strong>Coatings</strong> 11%</td>
</tr>
<tr>
<td>Salt spray testing - 2.5%</td>
</tr>
<tr>
<td>HDG versus EG versus Galvalume - 2.5%</td>
</tr>
<tr>
<td>Coating weight versus performance - 2%</td>
</tr>
<tr>
<td>Heat resistance - 2%</td>
</tr>
<tr>
<td>Prepaint - 2%</td>
</tr>
<tr>
<td>Formability - 2%; Specifications - 2%; Passivation - 2%</td>
</tr>
</tbody>
</table>
Corrosion Inquiries

- **Service life**
  - Atmospheric (indoors & outdoors)
  - In concrete
  - In contact with treated wood
  - Dissimilar metal contact
  - In soil and marine environments
- **Storage stain & salt spray**
- **Zinc runoff**
Atmospheric Service Life

*Service life is defined as the time to 5% rusting of the steel surface.*
Atmospheric - Indoors

Source: CSSBI
Atmospheric - Indoors

- **Galvanize for lightweight steel framing (LSF)**
  - Corrosion rate < 0.1 microns/year

- **Necessity for G90 for indoor use?**
  - Study LSF use in actual buildings
  - Develop database - life vs. environment

- **Use of lighter coating weights in appliances and electronic cabinetry**
Contact with Concrete

Source: SIMPSON Strong-Tie
Corrosion rate of galvanize imbedded in concrete is $<$0.1 microns/year if:

- Water/cement ratio $<$0.6
- Chloride content $<$1%

Not widely understood that chemistry of concrete can affect galvanize life

Advise no contact between 55% Al-Zn coated sheet and concrete
Contact with Treated Wood

Source: SIMPSON Strong-Tie
Contact with Treated Wood

- Wood preservative change results in increased corrosion of galvanized connectors
  - CCA-C changed to ACQ-C, ACQ-D, CBA-A, CA-B
- AC-D and CA-B over twice as corrosive as CCA-C due to higher Cu content
- G60 and G90 satisfactory in past
- Move to G185 or to stainless steel
- Study required to reduce corrosiveness of new treatments
## Dissimilar Metal Contact

### Galvanic Corrosion Rates - Zinc Coupled to Other Common Metals

<table>
<thead>
<tr>
<th>Coupled Alloy</th>
<th>Rural</th>
<th>Urban</th>
<th>Marine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc freely exposed</td>
<td>0.5</td>
<td>2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Mild steel</td>
<td>3.0</td>
<td>3.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>1.1</td>
<td>1.8</td>
<td>2.0</td>
</tr>
<tr>
<td>Copper</td>
<td>2.2</td>
<td>2.0</td>
<td>3.2</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.4</td>
<td>1.1</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Soil & Marine Environments
Soil & Marine Environments

- Soil
  - Inhomogeneous - data not available for many situations
  - Most recent large study - 1955

- Marine
  - Large variability in corrosion rates depending on location and water type
  - Heaviest coating weights recommended
Storage Stain
Storage Stain

- Storage stain is zinc hydroxide
- Most calls about how to remove
  - White stain - superficial and removable
  - Black stain - damages coating
- If removed - metallic sheen lost
- Many rejections for aesthetic reasons
- Restoration treatment needs to be found
Salt Spray Testing

- GalvInfoNote #15 covers most FAQs
- Does not predict service life
- Questions on hours to red rust versus coating thickness
Zinc Runoff
Zinc Runoff

- Some localities have adopted EPA guidelines on zinc levels in runoff water as regulations
- Runoff model under study - results being presented at this conference
- Indications are zinc levels drop before water reaches streams
Appearance Inquiries

- Bonderized (phosphatized) galvanize
  - Being used in unpainted state - despite uneven gray appearance
  - Need to develop a prepainted product that has Bonderized look
- How to dull metallic sheen of galvanize
- How to paint weathered/rusted galvanize
Weldability

- How does arc welding of 55% Al-Zn differ from that of galvanize?
- How to solder phosphatized galvanize?
- How does spot welding affect corrosion resistance of galvanize?
- GalvInfoNote on Weldability to be issued
Passivation

- Issue of hexavalent chromium becoming important
  - Cr bearing passivation cannot be guaranteed free of Cr$^{+6}$
- Demand for chromium-free passivation treatments will increase sharply
Other Inquiries

- Temperature resistance of galvanize
- Use of 55% Al-Zn in cooking appliances
- Fire ratings
- Clarification of specifications
- Formability issues
- Where to purchase coated sheet
Summary

- Data base-actual corrosion of LSF
- Guide to coating weight selection of LSF
- Guide to use of galvanize in concrete
- Complete study of corrosiveness of new wood preservatives
- Better methods of removing white rust
- Finalize zinc runoff studies
- Market for low-gloss architectural panels
- Deploy chrome-free passivation
- Obtain fire ratings for buildings using LSF
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