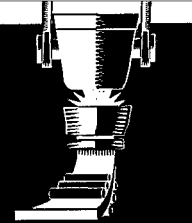


STEEL

Project Fact Sheet



ENERGY-EFFICIENT PROCESS FOR HOT-DIP BATCH GALVANIZING

DOE/GO--10098-561

LEAD-FREE ZINC COATINGS SAVE ENERGY AND WASTE

RECEIVED
MAY 07 1998
OSTI

BENEFITS

- The ability to produce defect-free and lead-free zinc coatings
- Allows productivity increase of 20-30%
- Significantly reduced energy costs
- Reductions in dross, top ash, and smoke
- Products meet specifications with 10% to 50% thinner coatings
- Top-flux use on the kettle eliminated
- Increased expected kettle life span

Hot-dip galvanizing of steel sheets, pipes, and other fabrication items is a popular method of corrosion protection. Currently, steel articles are immersed in molten zinc at 860°F, thereby forming a "frozen" metal (interfacial zinc iron intermetallic layer) on the surface. Drawbacks to the current technology include the expense of heating parts at such a high temperature and the generation of by-products such as zinc alloys, zinc oxides, and smoke.

Furthermore, new federal regulations have significantly reduced acceptable lead levels in coatings, because lead from galvanized, coated steel will dissolve in water. Such dissolved lead may accumulate in human bodies with deleterious results. Additionally, the use of a molten salt layer on top of zinc (top-flux) causes kettle smoke and ash evolution.

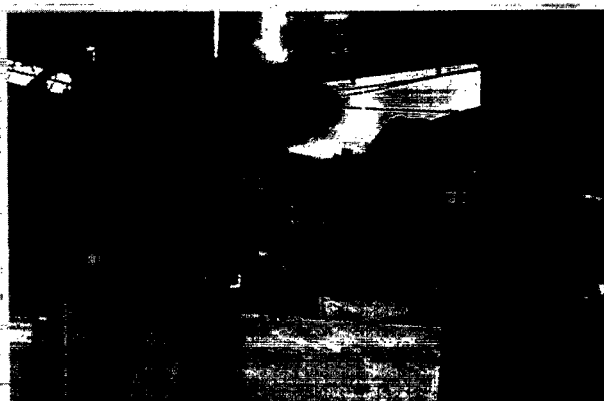
Ferro Technologies, Inc. has proposed a lead-free batch technology that will significantly improve the galvanizing process. The new Thermo Prep™ process protects steel surfaces with a thermally stable flux by preheating parts to 400° to 450°F in a separate furnace, and then immersing them in molten, lead-free zinc for a short period of time. The use of a thermally stable pre-flux would eliminate the need for top-flux, thereby reducing associated wastes.

APPLICATIONS

Steel is a component of a wide range of products and makes up the building blocks of the construction, automotive, and machinery industries, among many others. Coating steel products to protect them is a popular practice which stands to grow even more with the development of high-quality lead-free coating processes

HOT-DIP BATCH GALVANIZING IS CLEAN, EFFICIENT

The Thermo Prep™ process demonstrated by Ferro Technologies, Inc. preheats steel parts, and then immerses them in molten, lead-free zinc in a separate furnace to save energy and reduce defects.



Technology Advantages

The new technology provides hot-dip batch galvanizers with the following advantages: (1) a 20%-30% productivity increase; (2) significant energy cost reduction; (3) dross, top ash, and smoke reduction; (4) 10%-50% coating thickness reduction to meet specification requirement; (5) elimination of top-flux use on the kettle; (6) the ability to produce defect-free and lead-free zinc coatings; and (7) increased kettle life.

Current Status

The equipment is in place at the Laclede steel plant in Alton, IL, and Ferro Technologies is currently optimizing the system. The kettle handling system is being redesigned to reduce pipe immersion time. Ferro Technologies demonstrated the system to DOE personnel in March, 1998.

ENERGY SAVINGS PER UNIT* (PROJECTED)

| | |
|--------------------------|-------------|
| Current Energy Use (Btu) | 1 billion |
| With Proposed Technology | 486 million |
| Energy Savings | 514 million |

WASTE SAVINGS PER UNIT* (PROJECTED)

| | |
|--------------------------|-------|
| Current Waste (tons) | 3,800 |
| With Proposed Technology | 2,500 |
| Waste Savings | 1,300 |

ECONOMIC SAVINGS PER UNIT* (PROJECTED)

| | |
|--------------------------|-----------------|
| Current Costs | \$1.194 million |
| With Proposed Technology | \$807,600 |
| Cost Savings | \$386,400 |

*for a facility galvanizing 6,960 tons of steel per year

INDUSTRIES OF THE FUTURE—STEEL

Through OIT's Industries of the Future initiative, the Steel Association, on behalf of the steel industry, has partnered with the U.S. Department of Energy (DOE) to spur technological innovations that will reduce energy consumption, pollution, and production costs. In March 1996, the industry outlined its vision for maintaining and building its competitive position in the world market in the document, *The Re-emergent Steel Industry: Industry/Government Partnerships for the Future*.

OIT Steel Industry Team Leader: Scott Richlen (202) 586-2078



NICE³—National Industrial Competitiveness through Energy, Environment, Economics:

An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to \$400,000. Grants fund up to 50% of total project cost for up to 3 years.

PARTNERS

Ferro Technologies Inc.,
Pittsburgh, PA

LaCled Steel Company,
Alton, IL

Pennsylvania Department of
Environmental Protection

Advanced Thermal Dynamics, Inc.,
Liberty, OH

FOR MORE INFORMATION

NICE³ Web site:
<http://www.oit.doe.gov/Access/nice3/>

NICE³ program contact:
Steve Blazek
Golden Field Office, DOE
1617 Cole Boulevard
Golden, CO 80401
(303) 275-4723
(303) 275-4288 (fax)
steve_blazek@nrel.gov

Ferro Technologies, Inc.:
Thomas L. Ranck
University of Pittsburgh
Applied Research Center
1125 William Pitt Way
Pittsburgh, PA 15238
(412) 826-3239
(412) 826-3247 (fax)

Office of Industrial Technologies
Energy Efficiency and Renewable
Energy
U.S. Department of Energy
Washington, D.C. 20585



DOE/GO-10098-561
April 1998

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

**Portions of this document may be illegible
electronic image products. Images are
produced from the best available original
document.**