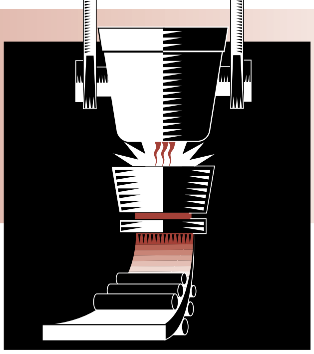
STEEL

Project Fact Sheet



Life Improvement of Pot Hardware in Continuous Hot Dipping Processes

Benefits

- Estimated energy savings of two trillion Btu per year at full-scale implementation
- Estimated cost savings of $46 million per year
- Reduced CO_2 emissions resulting from the adoption of improved galvanizing bath hardware designs and materials from this project

Applications

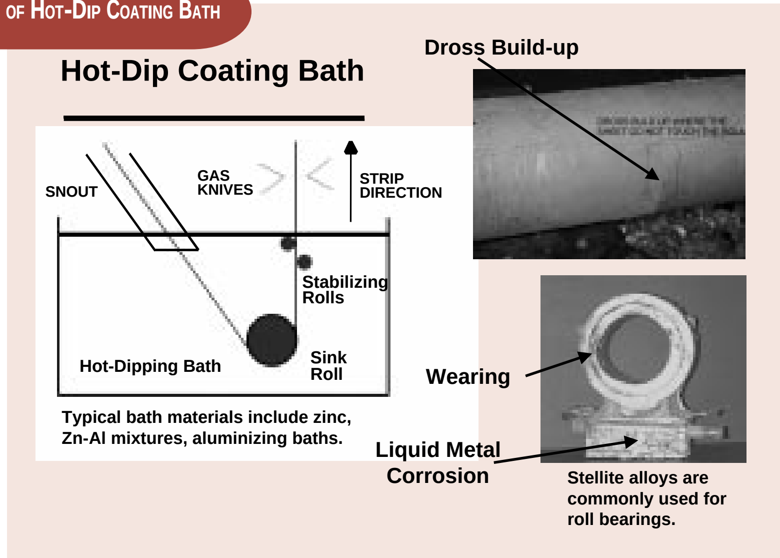
Successful improvement in the life of pot hardware in continuous hot dipping processes would apply to the 57 existing coating lines in the U.S., thereby allowing energy savings, reduction of line downtime and yield loss, improvement in overall sheet quality, reduced cost of repair and replacement cost of corroded components, environmental improvements, and improved economics.

Improving galvanizing bath hardware and materials in hot dip processes for the production of steel strip may result in a total savings of $1 billion per year at full-scale implementation

The coating of steel sheet by continuous hot dipping in a molten metal bath of zinc or in a Zn/Al melt is the most efficient and economical method of providing corrosion protection to most steel sheet compositions. However, the performance of galvanizing and Zn/Al molten metal bath hardware can strongly influence both the downtimes experienced by a line and coating quality. Typical coating lines operate for an average of two weeks prior to required downtime for maintenance of hardware. The three most important issues related to performance improvement of submerged galvanizing molten metal bath hardware include: (1) performance of bearings supporting the rotating components, such as sink, stabilizer, and deflector rolls; (2) corrosion of molten metal bath hardware in molten zinc including corrosion of materials subjected to sliding contact; and, (3) nucleation and growth of dross (intermetallic particles) on molten metal bath hardware, especially roll surfaces, causing cosmetic defects in strip coatings.

In response to the needs addressed in the *Steel Industry Technology Roadmap*, the research objectives of this project are to develop new bulk materials and surface treatment/coatings for life improvement of molten metal bath hardware and bearings in continuous hot-dip processes used for coating steel strip. The project goal is to result in extension of component life by an order of magnitude with estimated energy savings of of two trillion British thermal units (Btu) per year and cost savings of approximately $46 million per year for the 57 lines operating in the U.S.

Diagram of Hot-Dip Coating Bath



Technical challenges for pot hardware in continuous hot-dip coating baths are liquid metal corrosion, bearing wear, and dross buildup on roll surface.

Project Description

Goal: To enhance the molten metal bath hardware and bearing life by an order of magnitude -- increasing the typical life of two weeks to 20 weeks or more.

The primary objective of this proposal is to advance material technology to enhance (1) performance of bearings supporting the rotating components (sink roll, stabilizer roll, and deflector roll), and (2) reduce the corrosion of molten metal bath hardware components, such as sink roll, stabilizer roll, deflector roll, snout, and roll support arm. Successful completion will result in significant energy, environmental, and economic benefits.

The proposed research plan will achieve these objectives by the following:

1) Conducting materials characterization of currently used materials removed from service life in order to understand the mechanism of molten metal corrosion attack and bearing surface degradation.
2) Thermodynamic and kinetic modeling to identify formation of phases at the solid/molten metal interface. Results of the thermodynamic modeling will be measured by laboratory testing.
3) Performing failure analysis and thermodynamic modeling to design compositions of bulk materials and surface treatments/coatings.
4) Designing new alloys and coating and testing them under static and dynamic conditions for corrosion kinetics in four different molten metal compositions (zinc, Zn-5%Al, Zn-55%Al, and Al-8%Si). The corrosion data will be followed by wear testing of surfaces submerged in a molten zinc bath.
5) Evaluating commercial coating processes of alloys and surfaces previously found to have acceptable performance under laboratory conditions. Prototype component testing and analysis will follow these data.

Progress and Milestones

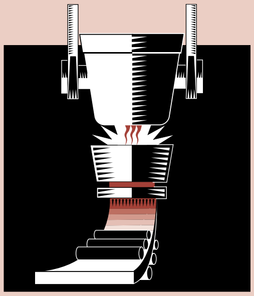
- Project Start Date: April 2001
- Task 1: Failure Analysis and Materials Characterization (August 2003)
- Task 2: Materials/Process Modeling (May 2003)
- Task 3: Materials Development (June 2003)
- Task 4: Materials Testing/Analysis (May 2003)
- Task 5: In-Plant Testing and Trials (March 2004)
- Task 6: Meetings and Technical Reports (March 2004)
- Project End Date: March 2004

Commercialization Plans

Team partners of the project consists of steel companies, material and component producers, research organizations, national laboratory, and academia. The research breakthrough will be applied to the committed production lines for practical trial. New technology will be transferred to industrial partners and their vendors directly.

Project Partners (Continued)

GalvPro, Jefferson, IN
Industries of the Future -- West Virginia Program, Morgantown, WV
International Lead and Zinc Research Organization, Inc., Research Triangle Park, NC
Metallics Systems Company, Solon, OH
National Steel Corporation, Mishawaka, IN
Oak Ridge National Laboratory, Oak Ridge, TN
Praxair Surface Technologies, Inc., New Castle, PA
Steel Dynamics, Inc., Butler, IN
Stoody Company, Bowling Green, KY
Vesuvius McDanel, Beaver Falls, PA
Weirton Steel Corporation, Weirton, WV
West Virginia Steel Futures, Inc., Weirton, WV
Wheeling-Nisshin, Inc., Follansbee, WV



Project Partners

West Virginia University Research Corporation
West Virginia University
Morgantown, WV
(Principal Investigator)

AK Steel Corporation
Middletown, OH

ASB Industries, Inc.
Barberton, OH

Bethlehem Steel Corporation
Bethlehem, PA

California Steel Industries, Inc.
Fontana, CA

Deloro Stellite, Inc.
Goshen, IN

Duraloy Technologies Inc.
Scottdale, PA

Fontaine Engineering, Inc.
Bridgeport, WV

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