



INDUSTRIAL TECHNOLOGIES PROGRAM

SQA™: Surface Quality Assured **Quality Control Program Minimizes Surface Defects in Hot Rolled Steel Bar Production**

This project is intended to alleviate surface quality problems faced by the U.S. special quality steel bars and rods industry, and their customers, the U.S. forging industry. During steel production, surface defects in the steel formed in the hot rolling process account for 50% of material rejects, or 2.5% of the total steel shipments, factors that affect efficiency and operation costs. Conventional statistical sampling techniques only enable a small portion of the material to be inspected. Because most surface defects in steel production are sporadic and unpredictable, these conventional methods are not practical options for monitoring product quality.

OG Technologies, Inc., will lead research that seeks to address this issue through the development of a Surface Quality Assurance (SQA™) program to enable efficient rolling process control and effective product quality control. The program will use several new innovations to create and demonstrate an SQA™ prototype, including HotEye™, a technology developed by OG Technologies that can deliver high-definition images of workpieces at or exceeding 1,450°C.

This project seeks to minimize surface defects in hot rolled steel products by developing online automatic root cause identification capability. This capability involves using HotEye™ technology to detect surface defects,



Applications and Benefits

This technology will help create a new steel rolling mill operation paradigm. Benefits of this technology include:

- Rapid detection and response to surface defect problems
- Improved surface quality control of deliverables
- Minimization of defect-related costs
- Improved product quality



This first commercial prototype was used to test SQA™ program features. The system is installed in a steel rod mill, where rolling speeds exceed 60 meters per second.

combining the findings with information from other process sensors, and applying advanced diagnostic methodologies to analyze the data.

Besides HotEye™, other project capabilities include:

- In-line, real-time imaging-based visual inspection for surface defects on hot rolled steel bars;
- In-line, real-time imaging-based speed measurement for high-speed hot rolled bars;
- Modal-based vibration reduction for enhanced instrumentation performance in hot rolling lines;
- Advanced data analysis for process signatures and root cause identification;
- Predictive process control to prevent surface defects; and
- A new business paradigm between steel and forging, based on defect detection, marking, and removal.

For the special quality bar rolling and forging industry, applying the findings from this program could potentially reduce operational costs by 2.5% or over \$200 million per year and save 6 trillion Btu per year.

The technologies developed in this project can be applied to other industries, such as steel sheet rolling and paper rolling.

Project Plans and Progress

Project History: This project was awarded under the Sensors, Controls and Automation Crosscutting Technologies solicitation. The award was signed in the spring of 2004.

Project Tasks

The goal of this project is to develop and demonstrate an SQA™ that enables efficient steel rolling process control and is capable of automatic and effective product quality control. Major research efforts are organized into five tasks:

- Development of an imaging-based sensor
- Performance of sensor-based process pattern analysis
- Creation of an approach to improve process monitoring and identify root causes of surface defects
- Creation of a method to prevent and/or eliminate surface defects
- Integration of project systems

Project Partners

OG Technologies, Inc. (Lead organization)

University of Michigan

University of Wisconsin

Charter Steel

Metaldyne

U.S. Department of Energy

Contact

Terence C. Liddy
OG Technologies, Inc.
4300 Varsity Drive
Ann Arbor, MI 48108
Phone: (734) 973-7500
Email: Liddy@ogtechnologies.com

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



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Energy Efficiency
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Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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This commercial system is installed in a bar mill that rolls steel bars ranging in diameter from 0.5 in. to over 1.5 in. The HotEye™ system is the blue unit visible towards the right in the picture.