Industrial Technologies Program

Energy Efficiency Instrumentation

All manufacturing operations have several sources of variability that need to be controlled, and the metalcasting process is no exception. This is more challenging when you are producing a wide variety of complex components. This project will develop better tools and strategies to collect and manage process and product data in the steel casting industry. The data will provide the knowledge base for companies to make better process control decisions that will enable productivity increases and energy savings.

Researchers at Iowa State University will address the application and development of sensor technologies to capture critical aspects of molding and post solidification processes. One of the major tasks is to shorten the heat treatment cycle by relying on new control data and strategies. This will have a direct reduction in energy, and also improve throughput since this process is often a bottleneck.

Currently, much of the cost to produce a casting is the hand grinding operations. Previous work has shown that this is also a major source of processing variability. This project will work towards developing a semi-automatic grinding system. One of the key components of this system is to still utilize an operator to control the movement, since the wide variety of part shapes makes a priori path planning infeasible.
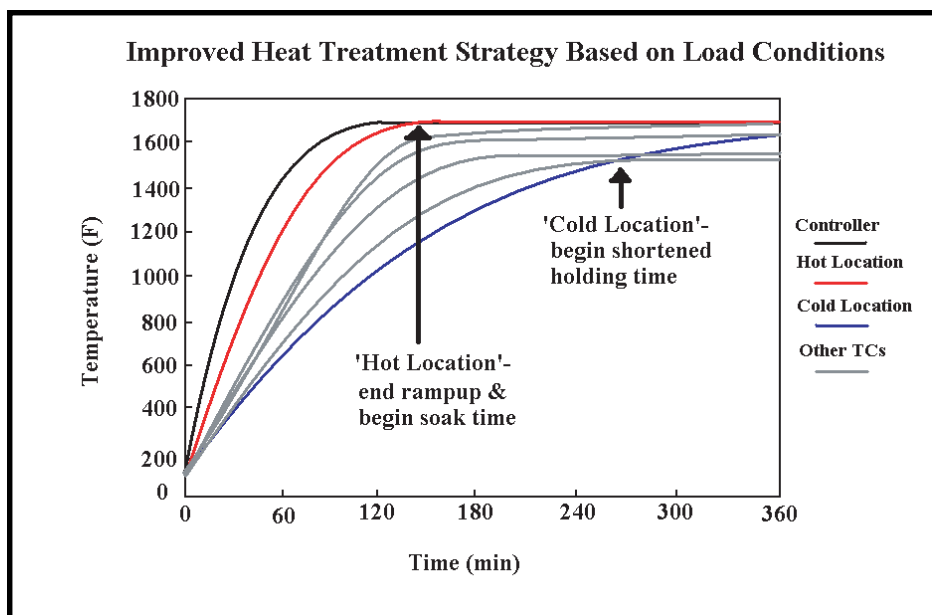
Benefits for Our Industry and Our Nation

- *Increase in productivity and throughput*

- *Reduced scrap and rework*

- *Faster deliveries*

- *Energy savings from better heat treatment control, less processing, less rework, and less scrap*

Applications in Our Nation's Industry

This research will provide the casting industry with better process knowledge and intelligent control decisions that can be made to eliminate the inefficient productivity and wasted energy associated with rework of castings. This will strengthen the competitiveness of this industry to insure a stable domestic supply of steel castings to support a variety of key industries.

Improved Heat Treatment Strategy Based on Load Conditions

'Cold Location'- begin shortened holding time

'Hot Location'- end rampup & begin soak time

Controller
Hot Location
Cold Location
Other TCs

Project Description

The goal of this project is to improve the manufacturing system at metalcasting plants through better instrumentation and process control. With better process knowledge, intelligent control decisions can be made to eliminate the inefficient productivity and wasted energy associated with rework of castings.

- Development of improved data capture of molding and post solidification processes.

- New heat treatment control strategies that will shorten the heat treatment time by basing decisions on casting temperature rather than the furnace atmosphere.

- Development of a semi automatic grinding system that still utilizes the human for process control to achieve the wide variety of geometries, but uses mechanical means to apply the optimal process force.

- Multifaceted technology transfer approach, including deployment of students on field studies, workshops, demonstration events, posters, presentations, and papers.

- Active student participation to provide invaluable productivity and energy efficiency experience.

Milestones

The milestones for this project are:

1. Shop Floor Data Collection Systems: Collect data and sensor development activities including molding and the post solidification casting operations.

2. Heat Treatment Control Strategies: Field studies on current control practices, utilize new sensors and data collection methods, and plant trials of new control strategies.

3. Grinding Control System: Develop a grinding control system in which machine will apply the force, and human will control the movement of the grinder.

4. Field Studies: Collect information on the manufacturing system, specifically the process and product variation and sensor and control needs.

5. Technology Transfer and Reporting: Deploy the researchers, perform site visits, and conduct workshops and presentations at appropriate industry outlets.

Project Partners

Iowa State University, Ames, IA
Steel Founders Society of America
Crystal Lake, IL
Cast Metals Coalition Partnership
Charleston, SC
Harrison Steel, Attica, IN
American Centrifugal
Birmingham, AL
Durametal Corp, Muncy, PA
Eagle Alloy, Muskegon, MI
Matrix Metals, Richmond, TX
Maynard Steel, Milwaukee, WI
Pacific Steel, Berkeley, CA
Sivyer Steel, Bettendorf, IA
Southwest Steel, Longview, TX
Spokane Steel Foundry
Spokane, WA
Stainless Foundry & Eng.
Milwaukee, WI
The Falk Corporation
Milwaukee, WI

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.

U.S. Department of Energy
Energy Efficiency
and Renewable Energy

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