

# ALUMINUM

Project Fact Sheet



## ENERGY EFFICIENCY IN ALUMINUM MELTING

### BENEFITS

The potential benefits of this project include:

- Saving approximately 13 trillion Btu per year in energy
- Improving energy efficiency of aluminum melting furnaces by 25 percent
- Significantly reducing greenhouse gas and NO<sub>x</sub> emissions

### APPLICATIONS

Aluminum processing requires melting large quantities of aluminum for subsequent production of semi-fabricated products including extrusions, sheet and plate. The efficient processing of aluminum is strategically important to the U.S. economy.

### IMPROVING ENERGY EFFICIENCY IN ALUMINUM MELTING

Reverberatory furnaces are the principal means used for melting aluminum. Such furnaces are refractory-lined vessels that typically employ natural gas-fired burners. Heat transfer is primarily from the flame to the roof and, to a lesser extent, the sidewalls of the furnace, and then to the melt. Although there are significant variations in design and operating procedures employed by the industry, all reverberatory furnaces suffer from large energy losses. The average melting furnace operates at 30 percent thermal efficiency.

Advancements in oxygen-air-fuel burners coupled with improved insulation, refractories, and sensors and control systems have the potential to reduce fuel demands, improve production rates, reduce greenhouse gas, and NO<sub>x</sub> emissions. Project partners will build an experimental reverberatory furnace (ERF) with the ability to vary burner design and physical furnace parameters. Results obtained from the ERF will be confirmed by modeling studies and then extended to full-scale furnaces. Cost benefit analysis of various designs will be developed.

### ALUMINUM MELTING FURNACE



Operator tending a typical aluminum melting furnace.



## Project Description

**Goals:** The research objective is to improve energy efficiency in aluminum melting by 25 percent.

## Progress and Milestones

- Evaluate melt and holding practices by furnace type, the control system, and feedstock to identify best practices.
- Design, build, and operate an experimental reverberatory furnace (ERF) to conduct trials on combinations of oxy-fuel, staged combustion, and new refractory/insulation.
- Model furnace mass, heat and fluid flow for developing industrial furnace design retrofits. The use of three-dimensional models based on rigorous principles of heat and mass transfer provides a unique computational framework for designing optimal furnace systems. These three-dimensional models are now available at the National Laboratories.
- Assess new intelligent and robust control systems for the combinations of oxy-fuel, staged combustion, and new refractory/insulation.
- Develop and demonstrate furnace modifications that satisfy the requirements identified by the partners.
- Conduct economic, technical, and barrier evaluations for implementation of the combinations of oxy-fuel, staged combustion, and new refractory/insulation.
- Demonstrate the most effective technologies in cooperation with the industry.

## Commercialization Plan

All industrial partners in the project will implement and use the technology. Upon completion of the project, the partners will make the technology available for licensing.

### The National Laboratory and University Participants in the project include:

- Albany Research Center - Albany, OR
- Argonne National Laboratory - Argonne, IL
- Oak Ridge National Laboratory - Oak Ridge, TN
- University of Kentucky - Lexington, KY



### INDUSTRY PARTNERS

Secat, Incorporated - Lexington, KY  
Alcan Aluminum Corporation - Cleveland, OH  
ARCO Aluminum, Incorporated - Louisville, KY  
Century Aluminum Company - Hawesville, KY  
Commonwealth Aluminum - Louisville, KY  
Hydro Aluminum - Louisville, KY  
IMCO Recycling, Incorporated - Irving, TX  
Logan Aluminum, Incorporated - Russellville, KY  
McCook Metals, L.L.C. - McCook, IL  
Ohio Valley Aluminum - Shelbyville, KY

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