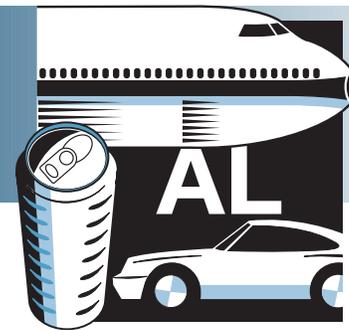


# ALUMINUM

## Project Fact Sheet



## DEMONSTRATION OF A HIGH-TEMPERATURE, CORROSION-RESISTANT COATING FOR RECUPERATORS

### BENEFITS

- Greatly reduces furnace energy use—melting furnaces using recuperators typically realize 20 to 30 percent energy savings; with 7,028 million pounds of secondary aluminum produced in 1995 at 5 million Btu per ton, this technology could potentially save 3 to 5 trillion Btu annually in secondary aluminum processing alone
- Extends the operational life of aluminum furnace recuperators, resulting in significant economic savings to the aluminum industry
- Increased recuperator use in the aluminum industry will dramatically increase industry energy savings
- Reduces recuperator downtime and attendant repair costs

### APPLICATIONS

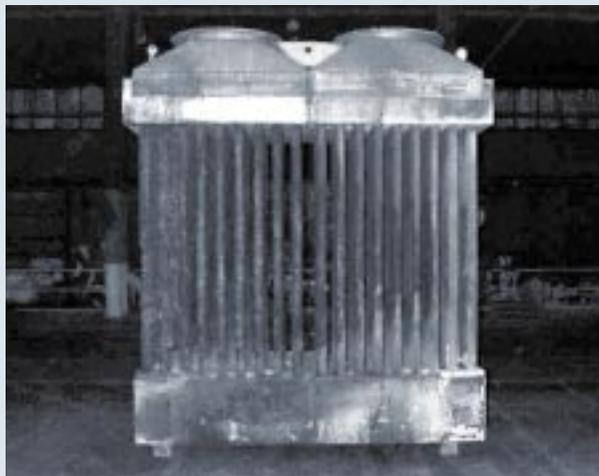
The coating allows the continued use of recuperators in corrosive environments without significantly detracting from their energy savings benefits. There is potential use for this product with other industries' recuperators, gas turbine blades, in high-temperature/high-pressure oxygen applications, and as a ceramic sealant to seal flame spray ceramic coatings that are normally porous and subject to corrosion from heat.

## A NEW PROCESS CREATES A CORROSION-RESISTANT RECUPERATOR THAT IMPROVES PLANT EFFICIENCY

Alcoa, under a grant from the Department of Energy's NICE<sup>3</sup> program, is demonstrating the full-scale use of a corrosion-resistant coating that extends the operational life of recuperators used in aluminum melting furnaces. Melting furnaces that use recuperators are typically 20 to 30 percent more energy efficient than those that operate without them. Currently, industry use of recuperators is limited due to high up-front capital and maintenance costs coupled with an extremely short recuperator life expectancy. The newly developed coating is expected to establish a solid economic benefit for increased recuperator use and result in a significant increase in energy savings for the aluminum industry.

This unique ceramic coating, developed under an earlier NICE<sup>3</sup> grant with Energy Research Company, is applied to exterior surfaces of furnace ventilation equipment, known as recuperators, which capture and reuse furnace emissions such as flue gas. Because more than 50 percent of a furnace's energy consumption exits the furnace as flue gas, thermal efficiencies (the ratio of heat going into scrap aluminum to that of the total energy used) as low as 19 percent are common. Recuperators have been proven to increase a furnace's thermal efficiency dramatically and effect significant energy savings. Flue gases from secondary melting furnaces can exceed 2200°F and are extremely corrosive, requiring costly replacement of conventional recuperator tube bundles every 1 to 2 years, which makes recuperator use prohibitively expensive. This new coating is expected to lessen the impact of these hot, corrosive gases and increase the economic viability of using recuperators.

### CORROSION-RESISTANT RECUPERATOR



The corrosion-resistant coating will significantly increase the operational life of furnace recuperators used in Alcoa's processing of aluminum.



## Project Description

**Goal:** Define and demonstrate the extended operational life of a full-scale recuperator using the newly developed ceramic coating. The exterior surfaces of a new recuperator will be coated, and the recuperator will then be placed in service. Normal diagnostic measurements will be taken during its operational life with recuperator failure criteria being unchanged from that currently in effect. Program goals target a 3 to 4 year coated recuperator life span.

Alcoa, Inc., is demonstrating this new technology with assistance from Energy Research Company, the Indiana Department of Commerce, and the NICE<sup>3</sup> Program in the Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- Demonstrate that the ceramic coating can be applied to recuperator tubes and exterior surfaces.
- Determine recuperator effectiveness by measuring tube life.
- Perform annual inspections.
- Remove and inspect recuperator when 10 percent of tubing fails.
- Disseminate technology to industry following demonstration.



NICE<sup>3</sup>—National Industrial Competitiveness through Energy, Environment, and 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 partners for the first commercial demonstration of energy efficient and clean production manufacturing and industrial technologies.

### PROJECT PARTNERS

Alcoa, Inc.  
Newburgh, IN

Energy Research Company  
Staten Island, NY

Indiana Department of Commerce  
Indianapolis, IN

NICE<sup>3</sup> Program  
Washington, DC

### FOR PROJECT INFORMATION, CONTACT:

Henry H. Guerke, Jr.  
Alcoa Technical Center  
Government Contracts (D-200)  
100 Technical Drive  
Alcoa Center, PA 15069-0001  
Phone: (724) 337-2557  
Fax: (724) 337-2209

### FOR PROGRAM INFORMATION, CONTACT:

Lisa Barnett  
Program Manager, NICE<sup>3</sup> Program  
U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585-0121  
Phone: (202) 586-2212  
Fax: (202) 586-7114  
lisa.barnett@ee.doe.gov

For project updates,  
visit our home page at  
[www.oit.doe.gov/nice3](http://www.oit.doe.gov/nice3)

Office of Industrial Technologies  
Energy Efficiency and Renewable Energy  
U.S. Department of Energy  
Washington, DC 20585-0121



DOE/GO-102001-0942  
Order# NICE<sup>3</sup>AL-6  
January 2001

## INDUSTRY OF THE FUTURE—ALUMINUM

*Through OIT's Industries of the Future initiative, the Aluminum Association, Inc., on behalf of the aluminum 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, **Aluminum Industry: Industry/Government Partnerships for the Future.***

OIT Aluminum Team Leader: Sara Dillich (202) 586-7925.