# A New Rapid Infrared Curing Process

*Automotive Propulsion System Materials*

U.S. Department of Energy

Energy Efficiency and Renewable Energy Program

Oak Ridge National Laboratory

UT-BATTELLE

Transportation

FOR THE 21ST CENTURY

## Background

The Lincoln LS vehicle manufactured by Ford Motor Co. has a welded seam in the middle of the C-pillar (behind the rear door). The finishing process for the seam included covering it with stitch MIG welds and thermal spraying it with silicon bronze after the body-in-white process and before painting. Five manual grinding stages were required to finish the joint with a smooth surface. The process is operator-dependent and is susceptible to quality concerns and throughput issues. Because the thermal spray coating is highly porous, it needs additional gray glaze and anti-chip material in the paint shop to produce a class-A finish.

A Ford researcher came to the Oak Ridge National Laboratory (ORNL) to discuss the potential for developing improved joining/brazing and resin curing technologies for this process. The researcher was familiar with some of ORNL's previous work on rapid infrared processing. Both the Automotive Propulsion System Materials Program and the Industrial Technologies Program have sponsored work on rapid infrared processes using equipment available in the MPLUS National User Facility.

## The Technology

A one-component epoxy material was chosen to replace the thermal-sprayed silicon bronze. The epoxy is conductive to the e-coat, fully paintable and sandable, and has low porosity. The next step was to find an efficient, robust in-line heating source to cure the epoxy coating. Several curing technologies were investigated. The most promising was based on the focused tungsten halogen lamp line heater in ORNL's Infrared Processing Center.

The infrared (IR) line heater can go from cold to full power in less than a second, convert electrical power into radiant energy at 90% efficiency, and target the energy to only the area that needs curing. It provided sufficient curing in very short process cycles. Further analysis in conjunction with a differential scanning calorimeter established the robust process window.

Full commercial-scale process trials were completed and the durability test passed. The IR lamp cured the epoxy in only 20 seconds from a distance of 6 inches and in a 10-inch-wide sweep to achieve a 92% cure suitable for grinding and sanding. The cure is completed later in the e-coat oven.

## Commercialization

Upon completion of the work at ORNL, Ford adopted the IR lamp technology in one of its plants. The process has been targeted for Job 1 production in the near future.

**Lincoln LS joint before (top) and after IR cure and finishing**

## Benefits

The benefits of using the epoxy filler and IR curing include:

- A cost savings of $28 per vehicle
- Less porosity in the coating
- A 2-minute reduction in cycle time
- Reduced energy consumption
- Elimination of five grinding steps
- Safer, more environmentally friendly processing

**Epoxy being cured with IR heating on the Lincoln LS prototype**

For more information on how ORNL is helping America remain Competitive in the  21st century, please contact:

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Success Story

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