Industrial Technologies Program

Lost Foam Thin Wall: Feasibility of Producing Lost Foam Castings in Al and Mg Based Alloys

Light metal aluminum and magnesium systems are steadily increasing their market share for structural components in transportation and military applications. Lost foam casting process is a cost-effective method for producing complex castings using an expandable polystyrene pattern and unbonded sand. The use of unbonded molding media in the lost foam process imposes less constraint on the solidifying casting, making hot tearing less prevalent. Some of the unique advantages of using a lost foam casting process are closer dimensional tolerance, higher casting yield, and the elimination of sand cores and binders. Most of the aluminum alloys poured using the lost foam process are based on the Al-Si system. Limited work is done with Al-Mg and Al-Cu type alloys. Magnesium components are currently produced by green sand and high-pressure die casting processes, requiring the use of cores and feeders to ensure defect-free castings. Lost foam casting of magnesium alloys is not yet a commercial reality.

With the increased emphasis on vehicle weight reduction, and given the high-strength-to-weight ratio of magnesium, significant weight savings can be achieved by casting thin-wall (<3 mm) engineering components from magnesium based alloys. A research team led by CANMET-MTL is conducting a feasibility study on the ability to produce a lost foam casting using magnesium based alloys. This project will improve the market share of components produced using the lost foam casting process.

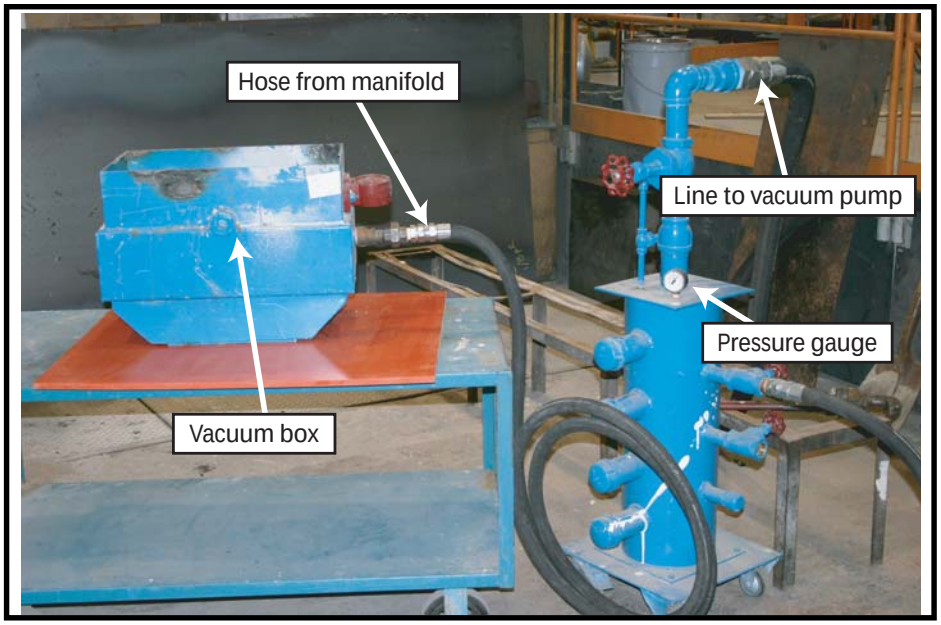

Figure 1: Vacuum box and pressure manifold system.

Benefits for Our Industry and Our Nation

- *Estimated energy savings over 10 years is 10.84 trillion Btu*
- *Improved casting yield with less scrap (approximately 65 percent with lost foam casting compared with about 50 percent or less for regular sand castings)*
- *Reduced hot tearing of cast components*
- *Accurately cast internal passage without core packages*
- *Reduced machining costs*

Applications in Our Nation's Industry

This project will improve the market share of light alloys, using the lost foam casting process. The significant weight savings of the alloys will reduce the fuel cost for transportation and military applications.

Project Description

The main objectives of this project are to:

- Develop appropriate lost foam casting technology for near-net shape prototype engineering components from magnesium alloys.
- Investigate the effects of vacuum molding and pouring techniques and low pressure on the quality of the prototype thin-wall components produced during lost foam casting.

Milestones

This project's planned tasks include:

1. Selection of prototype components after discussion with industrial partners
2. Design and fabrication of foam pattern
3. Computer simulation of lost foam process
4. Molding and casting of prototypes
5. Developing innovative lost foam casting processes
6. Casting evaluation: NDE and metallography
7. Evaluation of mechanical properties
8. Evaluation of corrosion properties

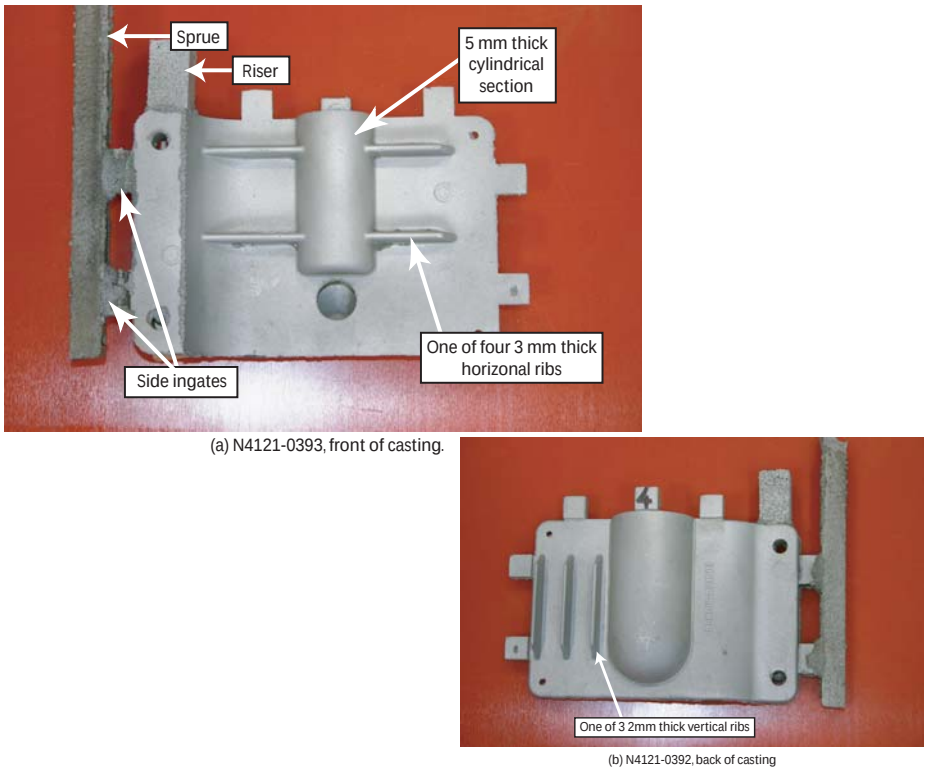

Figure 2: Defect free side-gated lost foam casting poured at 730°C.

Project Partners

CANMET-MTL
Ottawa, Canada

American Foundry Society
Schaumburg, IL

Cast Metals Coalition Partnership
Charleston, SC

ECK Industries, Inc.
Manitowoc, WI

Flow Science, Inc.
Pasadena, CA

Foseco-Morval, Division of Foseco Canada Inc., Bessemer, AL

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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