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Success Story

Success Through Partnership: Lost Foam

Industries of the Future approach advancing state-of-the-art in lost foam casting process

IOF Partnerships: Catalyst for Change

The U.S. Department of Energy, Office of Industrial Technologies, Metal Casting Industry of the Future (IOF) is facilitating partnerships to focus on near-, medium- and long-term research needs of the metal casting industry.

Through the IOF strategy, metal casting industry leaders are successfully leveraging limited resources. Cooperative partnerships are used to maximize investment in advanced technologies to solve pre-competitive technical problems and to create new applications for castings.

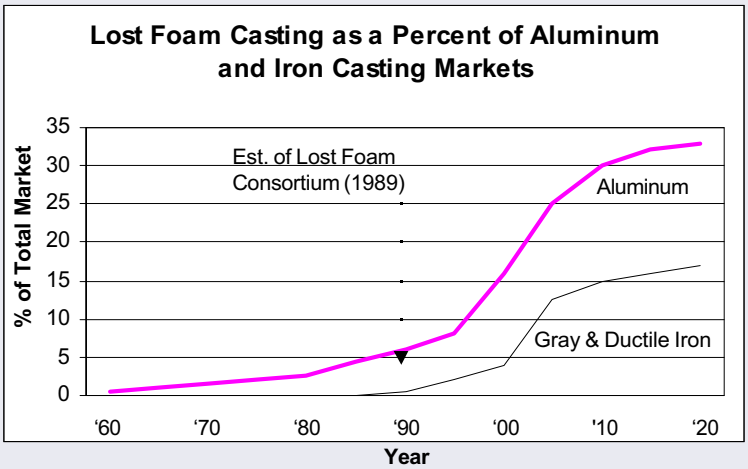
The majority of Metal Casting IOF-funded research is performed at the university level -- with solid backing from industry. The IOF has funded research at 18 universities and five laboratories across the U.S. This research is supported by a dollar-for-dollar cost share from industry. Over 150 industry partners in more than 30 states have participated in Metal Casting IOF research. Important by-products of the Metal Casting IOF initiative have been a substantial increase in foundry education in U.S. universities and the formation of new coalitions among industry companies to address common research needs.

The U.S. Department of Energy, Metal Casting Industry of the Future (IOF) facilitates partnerships between industry, academia and laboratories to address critical research needs facing the casting industry. One example of the success of this approach is Lost Foam Casting. The Lost Foam process has significant cost and environmental advantages including allowing designers to reduce machining, consolidate parts and minimize assembly operations while reducing solid waste and emissions. It also allows metal casters to reproduce complex curves and shapes that are often difficult with other methods. The advantages of the Lost Foam Casting Process had not been fully realized due to a lack of knowledge of the process needed to exercise proper control measures.

Between 1950 and 1990, there was virtually no growth in the use of lost foam casting. It accounted for less than 1% of steel and iron castings and less than 5% of aluminum castings. The future for lost foam casting, however, is much brighter. Since 1990, there has been a significant increase in the use of the process and the outlook is strong. ***By 2010, about 29% of aluminum castings and 15% of total iron castings are expected to be cast using lost foam casting technology. Much of this sudden increase can be attributed to the success of the Lost Foam Consortium.*** This Consortium of casting producers, users, foundry suppliers and the American Foundrymen's Society was started in 1989 to develop a better understanding of the lost foam process.

The Consortium partners with, and is partially funded by, the Metal Casting IOF. ***The IOF/Consortium strategy of cost-effective research partnerships, has been the catalyst for advancing the state-of-the-art in lost foam casting.*** Consortium research is performed at the Lost Foam Technology Center at the University of Alabama at Birmingham (UAB).

Increasing Market Share for Lost Foam



Research performed through the Lost Foam Consortium is significantly increasing the use of lost foam casting.

Project Description

Goal: This research is being conducted through the Lost Foam Technology Center at the University of Alabama at Birmingham. Specific goals have been to advance process control measures to produce high quality, high precision castings. Development and application of coating technology to the production of iron and aluminum castings was an early concern.

The consortium is the driving force behind technical improvements in the process. The efforts of the consortium are also resulting in rapidly growing markets for lost foam castings. An estimated 40,000 tons of lost foam aluminum castings were produced in 1994. This increased 25% to 50,000 tons in 1997. This is expected to increase 64% to 82,000 tons by the year 2000 -- resulting in an estimated rate of increase of 105% over the six year period. Even faster growth is expected for lost foam iron castings, increasing 100% between 1994 and 1997 from 20,000 tons to 40,000 tons, and then more than doubling to an estimated 85,000 tons in the year 2000. This brings a total increase of 325% for lost foam iron castings over the same six year period.

Progress and Milestones

Research co-funded by the U.S. Department of Energy is advancing the state-of-the-art in critical knowledge and technologies needed to further lost foam casting processes. Examples of recent developments include:

- A single stage air gauging system was developed, followed by a 30-channel commercial air gauge for rapid determination of pattern dimensions.
- Instruments and transducers were developed for measuring vibrational frequencies and amplitudes on compactor tables, on flasks and in sand. Sand vibrational amplitude and direction is important in achieving efficient compaction.
- A distortion gauge was developed to determine when and under what conditions pattern distortion occurs during compaction.
- A fill gauge was developed that can be put in a pattern cavity to determine the conditions that optimize sand to flow and fill.
- Two types of compaction gauges were developed to measure sand density in cavities during pattern compaction.
- A procedure was developed to measure the liquid absorption characteristics of liquid pattern pyrolysis in castings.
- An instrument was developed to measure the gas permeability of pattern coatings. Gas permeability controls the flow of metal into the pattern cavity and has a dominant effect on casting surface quality.

These devices have been successfully applied in a variety of commercial foundries.

Project Partners

University of Alabama at Birmingham,
Lost Foam Technology Center

Cast Metals Coalition

American Foundrymen's Society

Lost Foam Casting Consortium:
Advanced Cast Products, Inc.; Ashland Chemical Co.; Austin Associates; BMW AG; Borden, Inc.; Bradken Marion Corp.; Catepillar, Inc.; Carbo Ceramics; Citation Corp.; Copeland Corp.; Foseco-Morval Inc.; General Kinematics Corp.; General Motors; J.S. McCormick; Kohler Company; Lost Foam Technologies; Matrix Technologies; Mercury Marine; Mueller Corp.; Nemak, Saturn Corp.; Stanton PLC; Styrochem International; Tecpro Corp.; Maco Corp.; UES Inc.; Vulcan Engineering; Willard Industries

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