Ceramic Composite Die for Metal Casting

New Ceramic Composite Materials to Produce Superior, Low Cost Dies

Metalcasting, a major U.S. industry, has long been hampered by the high cost and short life of casting dies. Steel dies often fail prematurely due to metal fatigue cracking, corrosion, erosion, oxidation, heat checking, and soldering when the dies are exposed to molten metals while operating under cyclic-mechanical and thermal loading.

For some applications, coatings are applied to protect the die from the damage inflicted by molten metals. However, these coatings can fail prematurely and tend to interfere with the welding and polishing operations needed during reworking and correcting damages in the die.

With assistance from the Department of Energy's Inventions and Innovation Program, the Materials and Electrochemical Research Corporation has developed ceramic composite materials as an alternative to conventional material used in forming casting dies. Ceramic composites can deliver proven stability to molten metals and are resistant to corrosion, erosion, oxidation, thermal fatigue, and cracking. In addition, lower-cost hybrid composites in the nitride/nitridecarbide family have the potential to last up to 10 times longer than coated steel dies with significantly lower weight. These new composites are expected to reduce the cost of many products fabricated in the United States and create stronger competitiveness in the domestic metalcasting industry.

Benefits

Productivity

The composite dies weigh approximately one-third less than traditional tool steel dies. The weight reduction saves time in production by eliminating some of the mechanical moving equipment.

Waste Reduction

The longer life of ceramic dies reduces the amount of waste produced by failed tool steel casting dies. The ceramic dies also produce fewer casting rejections, reducing the energy needed to recycle the rejected castings.

Overview

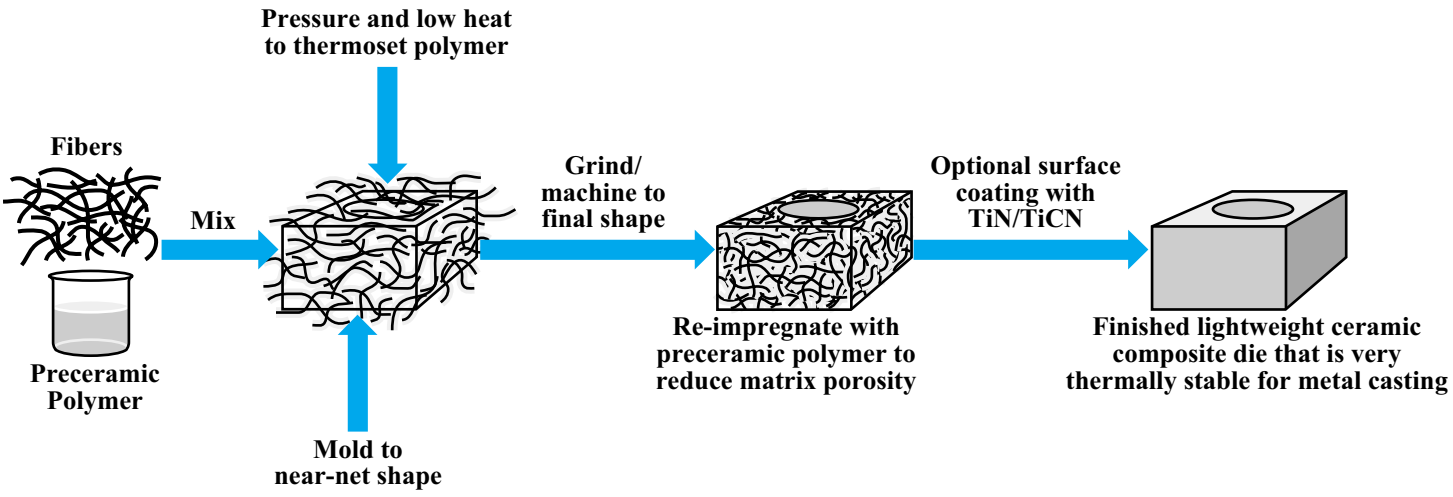
- Invented by the Materials and Electrochemical Research Corporation
- Commercialized in 2002
- Installed in several U.S. locations

Applications

Dies for metal casting, including replacement dies that are currently tool steel

Capabilities

- Offers resistance to corrosion, erosion, oxidation, thermal fatigue, and cracking.
- Provides stability when exposed to molten metals.
- 2 to 5 times harder than tool steels, resulting in 5 to 10 times longer useful die life.



Ceramic Composite Die Forming Process

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