

Novel 3-D Powder Refractory Materials for Investment Casting

Market and Background

Investment casting is a common technique used to produce high-quality cast metal parts. Current metal casting methods, such as investment casting, typically require several days from first pattern dip to molten metal pour and involve the use of a sacrificial pattern made from materials such as wax or foam as well repetitive and time consuming fabrication steps that involve curing. While this traditional technique produces high quality castings, it is time consuming and costly. With the improvement of additive fabrication techniques and hardware, there have been attempts to utilize existing foundry recipes with 3-D powder printers for the production of ceramic shells. However, adaptability has been a challenge and efforts to date to eliminate the lengthy curing and heat treating processes traditionally involved have not been successful.

Research and Development Status:

Research out of the University of Wisconsin-Whitewater and Florida State University has resulted in patented refractory mold recipes and associated methods for the investment casting and rapid prototyping industries. These novel materials and methods of manufacture are a seamless fit for current 3-D powder printers in the marketplace. This technology is capable of producing shell materials that can withstand temperatures up to 3,000°F and can be more easily removed from finished castings than products currently on the market. 'Pattern to pour' time and shell weight/thickness is also significantly decreased. In addition, this technology entirely eliminates the need for a sacrificial pattern for each refractory shell, and further reduces the time and cost of manufacturing by way of directly printing the 3-D refractory shell from a powder printer dispensing the proprietary recipe. Extensive laboratory testing has been completed. Universal recipes associated with 3-D powder printing applications have been developed and validated in relation to their utility in generating refractory metal casting molds for use in industrial and art investment casting foundries.

Applications:

3D prototyping and manufacturing for a wide variety of uses including Aerospace, Medical and Dentistry, Oil and Gas.

Key Benefits:

- Ready to pour ceramic molds without the need for a sacrificial pattern or pattern removal
- Hydraulic set as opposed to colloidal silica, providing for no or low shrinkage in shell and inner cavity
- No curing process required, allows for immediate use, reduced time of production and fewer fabrication steps
- Broad temperature tolerance and compatible with a wide range of metals
- Decreased shell weight and thickness and highly detailed surface finishes

Intellectual Property:

US and EU Patent Applications are pending for this technology. For more information, please contact Jennifer Souter at jennifer@wisys.org or by phone at 608-316-4131.

Development and Commercialization Needs:

WiSys is currently seeking strategic partners in the 3D printing and material supply industry that are interested in accessing and commercializing its patented process and associated recipes for refractory molds for the investment casting industry.