Hybrid Rapid Prototyping Approach For Rapid Casting Applications

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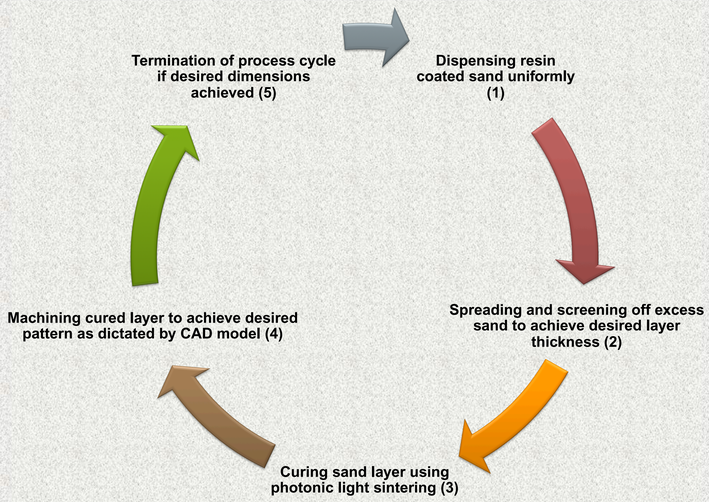
Introduction

Developments in rapid casting technologies have led to a new era of inclusion of 3D printing. Three-Dimensional (3D) printing provides the flexibility and ease of reproducing a sand mold directly from CAD models, eliminating patterning steps, thus reducing the process time for creating prototypes. In addition to minimizing processing steps, 3D printing provides the advantage of higher precision and the ability to produce complex shaped sand molds, but it simultaneously possesses some limitations and concerns related to throughput, safety and logistics.

The current invention involves both an additive and subtractive approach to selectively integrate machining with a high photonic curing mechanism. The photonic curing mechanism involves the use of intensive pulsed light in conjunction with a thermal setting resin coated sand to significantly reduce the time and energy required to build casting molds or cores for the foundry industry. The intensive pulsed light is used to quickly heat the resin-coated sand to its thermal setting temperature eliminating the need for any further curing or conditioning processing steps.

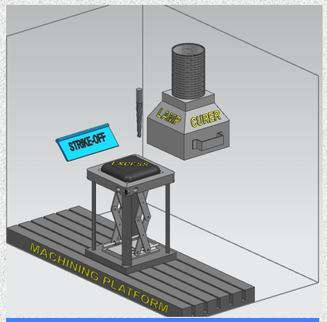
Method



The precision machining step which follows the photonic light sintering step enables the desired design parameters to be achieved as dictated by the system's computer aided modeling software file. The combined use of additive and subtractive technologies enables complex 3D structures to be produced, which are not achievable by either process alone and with high process throughput.

The thicknesses of the deposited layers demonstrated to date are up to 40X greater than what is currently being achieved in industry using other additive manufacturing techniques for rapid casting applications.

Process Schematics



Required Tools in the Process

Application Areas

Automotive Industry (Eaton, Ford, GM, Chrysler, etc.)

Entertainment (Formula one racing)

Agriculture industry (John Deer, etc.)

Construction industry (Caterpillar)

Defense Industry (DARPA, replacement parts and new weapon prototypes, etc.)

Energy Industry (Wind turbine blades, hydraulic turbines, oil and gas pumps, etc.)

Aeronautical Industry (Jet engines)

Shipping Industry (Propeller blades, anchors, etc.)

Medical and Biomedical Industry

Advantages

Higher throughput as compared to Additive Manufacturing techniques (3D Printing).

Safety and logistics.

Longer shelf life as compared to 3D printed Furan binder systems.

Less sand-metal ratio by creating shell.

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