Evaluation of AM Technologies in MIM Applications: Part 2.

Joseph Tunick Strauss[*], R. Michael Stucky[†], Matthew Bulger[††]

[*] HJE Company, Inc. 820 Quaker Rd., Queensbury, NY 12804

[†] Norwood Medical 2002 Webster St, Dayton, OH 45404

[††] atpm consulting, 1820 Miles Standish Lane, Hudson, OH 44236

ABSTRACT

Part 1 of this study investigated the feasibility of producing a MIM-like part via metal AM technologies, specifically Binder Jetting, Material Extrusion, and Photopolymerization of metal-loaded photopolymers. These new AM technologies are of interest to MIM companies as they leverage much of the knowledge base of MIM and, in some cases, use similar powders. These AM technologies have the potential to enable the production of MIM-like parts at production volumes not economically practical via MIM.

The outcome of Part 1 was that these technologies make a case for their ability to produce candidate parts and the resulting cost structures were feasible for low production numbers.

This current portion of the study will examine actual parts made by these various technologies and evaluate their abilities to achieve tolerances, surface finishes, and densities.

INTRODUCTION

In Part 1, prints of three parts specifically designed for MIM were presented to equipment manufactures of sinter-based AM technologies: Binder jetting (BJ), Material Extrusion (ME), and Vat Photopolymerization (VP). These companies were asked to provide cost quotations on these parts. They were also asked to provide feedback on the ability of their technologies to satisfy the tolerance and surface finish requirements of the prints. Of the twelve companies initially contacted, five replied with quotes and data. These represented three binder jetting technologies, one material extrusion technology, and one vat photopolymerization technology.

The primary conclusion was that these AM technologies had great potential to produce competitively priced parts at small quantities that are not feasible with MIM. For all Metal AM the costs are driven primarily by build time and material cost whereas MIM costs for low volume applications are driven primarily by tooling costs. The ability to produce parts without tooling offset the relatively slow build and scale of the Metal AM operation. Another advantage of the AM technologies was the very short lead times needed to produce the parts. Again, this is mainly the result of not requiring fixed tooling.