World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:13, No:11, 2019

Investigating the Effectiveness of a 3D Printed Composite Mold

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Abstract : In composite manufacturing, the fabrication of tooling and tooling maintenance contributes to a large portion of the total cost. However, as the applications of composite materials continue to increase, there is also a growing demand for more tooling. The demand for more tooling places heavy emphasis on the industry’s ability to fabricate high quality tools while maintaining the tool’s cost effectiveness. One of the popular techniques of tool fabrication currently being developed utilizes additive manufacturing technology known as 3D printing. The popularity of 3D printing is due to 3D printing’s ability to maintain low material waste, low cost, and quick fabrication time. In this study, a team of Purdue University School of Aviation and Transportation Technology (SATT) faculty and students investigated the effectiveness of a 3D printed composite mold. A steel valve cover from an aircraft reciprocating engine was modeled utilizing 3D scanning and computer-aided design (CAD) to create a 3D printed composite mold. The mold was used to fabricate carbon fiber versions of the aircraft reciprocating engine valve cover. The carbon fiber valve covers were evaluated for dimensional accuracy and quality while the 3D printed composite mold was evaluated for durability and dimensional stability. The data collected from this study provided valuable information in the understanding of 3D printed composite molds, potential improvements for the molds, and considerations for future tooling design.

Keywords : additive manufacturing, carbon fiber, composite tooling, molds
Conference Title : ICAMPT 2019 : International Conference on Aircraft Materials and Processing Technology
Conference Location : Tokyo, Japan
Conference Dates : November 11-12, 2019