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An Evaluation on the Effectiveness of a 3D Printed Composite Compression Mold

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Abstract : The applications of composite materials within the aviation industry has been increasing at a rapid pace. However, the growing applications of composite materials have also led to growing demand for more tooling to support its manufacturing processes. Tooling and tooling maintenance represents a large portion of the composite manufacturing process and cost. Therefore, the industry’s adaptability to new techniques for fabricating high quality tools quickly and inexpensively will play a crucial role in composite material’s growing popularity in the aviation industry. One popular tool fabrication technique currently being developed involves additive manufacturing such as 3D printing. Although additive manufacturing and 3D printing are not entirely new concepts, the technique has been gaining popularity due to its ability to quickly fabricate components, maintain low material waste, and low cost. 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 compression mold. A 3D printed composite compression mold was fabricated by 3D scanning a steel valve cover of an aircraft reciprocating engine. The 3D printed composite compression mold was used to fabricate carbon fiber versions of the aircraft reciprocating engine valve cover. The 3D printed composite compression mold was evaluated for its performance, durability, and dimensional stability while the fabricated carbon fiber valve covers were evaluated for its accuracy and quality. The results and data gathered from this study will determine the effectiveness of the 3D printed composite compression mold in a mass production environment and provide valuable information for future understanding, improvements, and design considerations of 3D printed composite molds.

Keywords : additive manufacturing, carbon fiber, composite tooling, molds
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