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ON THE APPLICATION OF BIOMIMICKED COMPOSITES IN 3D PRINTED ARTIFACTS

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**ABSTRACT**

Application of 3D printing to works of art is not new. However, with the advent of larger and more affordable 3D printers, it is possible to fabricate works of art including statues, sculptures, and architectural structures from biomimicked composites. Made of hard ceramic and soft polymer with or without reinforcement, these composites have shown to be much tougher than their monolithic counterparts. The use of biomimicking will increase the durability and strength of such artifacts. In this study, a newly developed architectural 3D printer is used to create works of art using concrete, with and without reinforcement fibers. The challenge that face creating tough artistic display structures include durability, hardness and resistance to impact. To determine the right combination of hard ceramic and soft polymer, a series of experiments were conducted. These included the fabrication of biomimicked composites with different materials and testing them for fracture energy as well as maximum strength. Earlier published works demonstrate the effect of various parameters such as type of ceramic layer, layering, fiber reinforcement type, fiber length, and fiber loading. In this paper, the effect of hard layer thickness and the type of polymer on the mechanical properties of the biomimicked composites was investigated. Preliminary results show the highest fracture energy for composites made with concrete bonding adhesive (CBA) and Quikrete™ concrete, with a spacing of 5mm. The application of 3D printing to the educational activities of a museum in Newport KY will be explained and its implication in relation with civic engagement activities of Northern Kentucky University will be elucidated.



**Fig. 1: A typical image scanned by iSense™ 3D scanner being examined for processing by the iSense Software from 3D Systems™ (Rock Hill, South Carolina, USA). As the scan proceeds the holes shown in green get filled (Image is courtesy of Evan Valentine).**

**INTRODUCTION**

Application of 3D printing to artwork has created a new dimension in art. Some impossible structures that could not be carved, cast or built before, have materialized, allowing creation of unexpected things. Museums have collected works of art printed in 3D by various artists as a way to attract visitors. One such museum is Newport History Museum of Northern Kentucky which has reached to