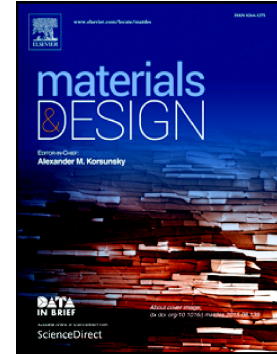


Accepted Manuscript

Evaluation of carbon fiber-embedded 3D printed structures for strengthening and structural-health monitoring

Xinhua Yao, Congcong Luan, Deming Zhang, Liujian Lan, Jianzhong Fu



PII: S0264-1275(16)31387-9
DOI: doi: [10.1016/j.matdes.2016.10.078](https://doi.org/10.1016/j.matdes.2016.10.078)
Reference: JMADE 2435
To appear in: *Materials & Design*
Received date: 23 September 2016
Revised date: 28 October 2016
Accepted date: 31 October 2016

Please cite this article as: Xinhua Yao, Congcong Luan, Deming Zhang, Liujian Lan, Jianzhong Fu , Evaluation of carbon fiber-embedded 3D printed structures for strengthening and structural-health monitoring. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. *Jmade*(2016), doi: [10.1016/j.matdes.2016.10.078](https://doi.org/10.1016/j.matdes.2016.10.078)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Evaluation of carbon fiber-embedded 3D printed structures for strengthening and structural-health monitoring

Xinhua Yao^{1,2}, Congcong Luan^{1,2,*}, Deming Zhang^{1,2}, Liujian Lan^{1,2} and Jianzhong Fu^{1,2}

¹The State Key Lab of Fluid Power Transmission and Control, College of Mechanical Engineering, Zhejiang University, Hangzhou 310027, China;

² Key Laboratory of 3D Printing Process and Equipment of Zhejiang Province, College of Mechanical Engineering, Zhejiang University, Hangzhou 310027, China;

*Author to whom correspondence should be addressed; E-Mail: lccshdg@126.com; Tel.: +86-15700078620; Fax: +86-571-8795-1145.

Abstract: This paper presents a technique for both structural reinforcement and self-monitoring of thermoplastic parts manufactured by fused deposition modeling (FDM). Continuous carbon fiber tows were embedded into FDM printed structures during the printing process, and the strength and piezoresistive behavior of the printed structures were evaluated. The specimens reinforced with carbon fibers have a tensile strength increase of 70% and flexural strength increase of 18.7% compared to non-reinforced specimens. In addition, the slope of fractional change in electric resistance with strain became a good indicator of strain measurement within the elastic region and damage detection in the yield region. Furthermore, lightweight and print duration reductions were achieved by decreasing the fill density while maintaining the structural strength, where up to 26.01% weight reduction and 11.41% print time reductions were achieved without decreasing the tensile strength. Finally, an artificial hand printed by FDM with embedded carbon fibers is discussed as a demonstration of this approach.

Key works: Carbon fiber, strengthening, monitoring, 3D printed structure, reinforcement

1. Introduction:

Recently, fused deposition modeling (FDM) has become one of the most popular 3D printing technologies due to its simplicity, low-cost, and the potential applications for the method [1, 2]. However, FDM products still have deficiencies regarding poor mechanical strength due to the inherent nature of thermoplastic resins, which greatly limit industrial applications [3-5]. On the other hand, reductions in material, as a sustainability requirement for industrial applications, is also of significant importance

Download English Version:

<https://daneshyari.com/en/article/5023986>

Download Persian Version:

<https://daneshyari.com/article/5023986>

[Daneshyari.com](https://daneshyari.com)