Accepted Manuscript

High through-plane thermal conductivity of polymer based product with vertical alignment of graphite flakes achieved via 3D printing

Yunchao Jia, Hui He, Yi Geng, Bai Huang, Xiaodong Peng

PII: S0266-3538(16)32097-8

DOI: 10.1016/j.compscitech.2017.03.035

Reference: CSTE 6720

To appear in: *Composites Science and Technology*

Received Date: 31 December 2016

Revised Date: 3 March 2017

Accepted Date: 24 March 2017

Please cite this article as: Jia Y, He H, Geng Y, Huang B, Peng X, High through-plane thermal conductivity of polymer based product with vertical alignment of graphite flakes achieved via 3D printing, *Composites Science and Technology* (2017), doi: 10.1016/j.compscitech.2017.03.035.

High through-plane thermal conductivity of polymer based product with vertical alignment of graphite flakes achieved via 3D printing

Yunchao Jia, Hui He*, Yi Geng, Bai Huang, Xiaodong Peng

School of Materials Science and Engineering, South China University of Technology.

Wushan Road, Tianhe District, Guangzhou City, Guangdong Province, China, 510640.

Correspondence to: Hui He. E-mail: pshuihe@scut.edu.cn

Abstract

The polymer/graphite based products fabricated by conventional molding method possess limited through-plane thermal conductivities (TPTCs) because the graphite flakes are strongly aligned in the in-plane direction. Based on the characteristic of fused deposition modeling (FDM, a trendy technology of 3D printing), rational design of 3D printing (3DP) process can make the graphite flakes orient along the through-plane direction. In this paper, high TPTC of polymer/graphite based products with graphite flakes vertically aligned are achieved via FDM. Although lots of voids generated during the fused deposition process, the optimal product shows a high TPTC as 5.5 $W \cdot m^{-1} \cdot K^{-1}$ because the fluent heat conductive pathways are not blocked by the voids. Finally, a heat sink with good thermally conductive property used for the 3D printer is successfully fabricated and it can well meet the heat dissipation requirement of 3D printer.

Keywords: Fused deposition modeling; polymers; thermal properties; anisotropy; scanning electron microscopy.