Accepted Manuscript

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PII: S1359-8368(17)34321-4

DOI: 10.1016/j.compositesb.2018.02.008

Reference: JCOMB 5533

To appear in: *Composites Part B*

Received Date: 13 December 2017

Revised Date: 2 February 2018

Accepted Date: 2 February 2018

Please cite this article as: Ghariniyat P, Leung SN, Development of thermally conductive thermoplastic polyurethane composite foams via CO_2 foaming-assisted filler networking, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.02.008.

Development of Thermally Conductive Thermoplastic Polyurethane Composite Foams via CO_2 Foaming-Assisted Filler Networking

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Abstract: In this work, thermoplastic polyurethane (TPU)-hexagonal boron nitride (hBN) composite foams have been fabricated by physical foaming processes using carbon dioxide (CO_2) as the blowing agent. Parametric studies were conducted to investigate the effects of saturation pressure, foaming temperature, and post-foaming elastic recovery on the composite foam's morphology and effective thermal conductivity. It was found that foaming-induced filler alignment and post-foaming elastic recovery of TPU synergistically facilitated the formation of interconnected thermally conductive filler network in TPU matrices. This represents a novel processing technique to fabricate TPU-hBN composite foams with enhanced effective thermal conductivity.

Keywords: A. Foams; Polymer-matrix composites (PMCs); C. Thermoplastic resin; Effective thermal conductivity