Accepted Manuscript

Performance study of ultrasonic assisted processing of CNT nanopaper/solventless epoxy composite

Dan Zhang, Maria G. Villarreal, Eusebio Cabrera, Avraham Benatar, L. James Lee, Jose M. Castro

PII: S1359-8368(18)32465-X

DOI: 10.1016/j.compositesb.2018.10.012

Reference: JCOMB 6090

To appear in: *Composites Part B*

Received Date: 5 August 2018

Revised Date: 3 October 2018

Accepted Date: 3 October 2018

Please cite this article as: Zhang D, Villarreal MG, Cabrera E, Benatar A, James Lee L, Castro JM, Performance study of ultrasonic assisted processing of CNT nanopaper/solventless epoxy composite, *Composites Part B* (2018), doi: https://doi.org/10.1016/j.compositesb.2018.10.012.

Performance Study of Ultrasonic Assisted Processing of CNT Nanopaper/Solventless Epoxy Composite

Dan Zhang[a], Maria G. Villarreal[c], Eusebio Cabrera[a], Avraham Benatar[d], L. James Lee[b], Jose M. Castro[a]*

[a] *Department of Integrated Systems Engineering, The Ohio State University, 1971 Neil Avenue, Columbus, OH 43210, United States*

[b] *Department of Chemical and Biomolecular Engineering, The Ohio State University, 151 West Woodruff Avenue, Columbus, OH 43210, United States*

[c] *Modeling Optimization and Computing Technology SAS de CV, Monterrey, NL, 64700, México*

[d] *Department of Materials Science and Engineering, The Ohio State University, 2041 N. College Rd, Columbus, OH 43210, United States*

Corresponding author: +1 6143780719
E-mail address: castro.38@osu.edu (Jose M. Castro)

Abstract

This work presents an innovative ultrasonic-assisted process for the fast infiltration of solventless epoxy into carbon nanotube (CNT) nanopaper (NP) (50 um thick thin film) to fabricate prepregs and composites. The effect of process parameters including: ultrasonic time (infiltration time), ultrasonic amplitude, pressure, and mold temperature on the resin impregnation quality and composite mechanical properties were evaluated. Nanopapers made of multi wall carbon nanotube (MWNT) or single wall carbon nanotube (SWNT) were used in this work. Homogeneous resin impregnation was achieved in the MWNT NP/epoxy composite with 30.5 wt. % MWNT loading. For coating applications, the MWNT NP/epoxy composite showed 167 % improvement in sand erosion resistance compared to glass fiber/epoxy composite. NPs with different MWNT wt. % and SWNT wt. % were fabricated. Although non-uniform resin impregnation was observed in SWNT NP/epoxy composites, there was still 142 % improvement in tensile strength compared to pure epoxy due to the rigid SWNT NP structure. The EMI shielding of SWNT NP reached 57 dB, which was higher than commercial carbon fiber preform (51 dB). The CNT NP/epoxy composites offer multi-functional properties, and demonstrate promising coating applications in wind energy, automotive and sporting goods industries.

Key words: Carbon nanotube; nanopaper; ultrasonic infiltration; nanocomposite.