Accepted Manuscript

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PII: S1359-8368(16)33286-3

DOI: 10.1016/j.compositesb.2017.07.075

Reference: JCOMB 5211

To appear in: *Composites Part B*

Received Date: 31 December 2016

Revised Date: 8 April 2017

Accepted Date: 29 July 2017

Please cite this article as: Aluko O, Gowtham S, Odegard GM, Multiscale modeling and analysis of graphene nanoplatelet/carbon fiber/epoxy hybrid composite, *Composites Part B* (2017), doi: 10.1016/j.compositesb.2017.07.075.

Multiscale modeling and Analysis of Graphene Nanoplatelet /Carbon Fiber/Epoxy Hybrid Composite

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Abstract

The elastic response of Graphene Nano Platelet/carbon fiber/epoxy hybrid composite was investigated using multiscale modeling and analysis. The importance of volume fraction of graphene, GNP dispersion, and strain rates on the mechanical behaviors was determined. The analysis entailed the building of computational molecular dynamic model, involving multilayer graphene nano-platelets in epoxy composite, and micromechanical modeling. The predicted results show that the elastic responses of the hybrid composite increase with increased GNP volume fraction, dispersion, and strain rates.

Keywords: Nano-structures, Mechanical properties, Computational modeling, Graphene

1. Introduction

Present day engineers are facing the challenge of creating products that perform better, but that are also smaller in size and weight. The need to model and carry out computational analysis of composite structures at atomic level is increasingly very important in order to develop stronger and lighter materials. Graphene nanaoplateletes (GNPs), are new carbon materials that have recently been developed. GNPs are short stacks of individual layers of graphite (called graphene), that often increase the tensile modulus of a composite material and are available at low cost. This nanostructured materials have shown promise for high-stiffness