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Authors: C.C. Roach, Y.C. Lu

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Analytical modeling of effect of interlayer on effective moduli of layered graphene-polymer nanocomposites

C.C. Roach, Y.C. Lu*

Department of Mechanical Engineering, University of Kentucky, Lexington, KY 40506-0503, USA

*Corresponding author. Tel.: +1 270 534 3115.
E-mail address: ycharles.lu@uky.edu (Y.C. Lu).
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Nanocomposites enhanced with two-dimensional, layered graphene fillers are a new class of engineering materials that exhibit superior properties and characteristics to composites with conventional fillers. However, the roles of "interlayers" in layered graphene fillers have yet to be fully explored. This paper examines the effect of interlayers on mechanical properties of layered graphene polymer composites. As an effective filler, the fundamental properties (in-plane Young's modulus E_{L1}, out-of-plane Young's modulus E_{L2}; shear modulus G_{L12}, major Poisson's ratio ν_{L12}) of the layered graphene were computed by using the Arridge's lamellar model. The effects of interlayers on effective moduli of layered graphene epoxy composites were examined through the Tandon-Weng model. The properties of the interlayer show noticeable impact on elastic properties of the composites, particular the out-of-plane properties (Young's modulus E_2 and shear modulus G_{12}). The interlayer spacing is seen to have much great influence on properties of the composites. As the interlayer spacing increases from 0.34 nm to 2 nm, all elastic properties of the composites have been greatly decreased.

Keywords: Interlayer; Layered Graphene; Nanocomposite; Effective Moduli