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ABSTRACT

The present study focuses on the development of carbon fiber reinforced polymers (CFRPs) with nano-modified matrix composed of two different carbon based nano-fillers, few layered Graphene Nano-Platelets (GNPs) and Multi-Walled Carbon Nanotubes (MWCNTs). The main purpose is to increase the interlaminar fracture toughness of CFRPs, by exploiting the synergistic effect between nano-fillers. Hybrid doped CFRPs were prepared in the first case by combining0.5%wt. GNPs and 0.5%wt. MWCNTs while in the second by 0.5%wt. GNPs and 1%wt. MWCNTs. Mode I fracture toughness (G_{IC})was enhanced up to 45% in the second hybrid whereas composites with GNPs or MWCNTs at equal amounts exhibited 27% and 31% increase respectively. Mode II results reported the second hybrid with the highest increase of G_{IIC} up to 25%, while individually the same contents achieved 18% and 13% increase. Finally, Scanning Electron Microscopy confirmed the synergistic associated mechanisms of hybrids compared to the reference material.

1 INTRODUCTION

Fiber reinforced polymers (FRP) are composites that are mainly used in advanced engineering structures. Their usage ranges in different areas including aerospace, automobile, sports and military industries. The key factor for the increasing demand of the composites in recent years is their higher specific strength and stiffness compared to the conventional metals. However, poor out of plane properties are observed due to the absence of through the thickness reinforcement in order to sustain transverse loads. Additionally, the low polymer matrix toughness leads to interlaminar failure, such as delamination. In light of this issue, an entire new field of research has been conducted, which includes developments for high performance resin systems with the incorporation of nano-sized particles [1-7].The nano-phase induces the concept of multi-scale reinforcements and introduces additional energy dissipation mechanics during fracture and thus contributes among others to the enhancement of the interlaminar fracture toughness of the composite.

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