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Graphite Nanoplatelets (GnP) Reinforced Composites: Improved Filler-Matrix Bonding using Atmospheric Plasma Treatment

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Graphite Nanoplatelets (GnPs) are currently being explored in a new type of carbon nanomaterials composites with unique electrical and thermal properties. However, achieving good interfacial bonding between these highly graphitic fillers and most polymer resins remains challenging. In our study, commercially available GnPs were exposed to varying degrees of an atmospheric plasma treatment (APT) to promote the filler to matrix bonding. X-ray photoelectron spectroscopy (XPS) of treated GnPs showed increases in chemical functionalization in terms of O/C ratio while scanning electron microscopy (SEM) and Raman spectroscopy showed associated changes to the graphitic microstructure and crystallinity. Fracture surfaces of the ensuing composites indicated improved GnP bonding for the APT treated samples, which were corroborated by increases in glass transition temperature (Tg). Increases in flexural strength were also observed with APT compared to the untreated specimen, although the modulus values were unaffected by APT. This work was supported by The Aerospace Corporation's Independent Research and Development program.

Keywords: composites, functionalization of polymers, nanoparticles, mechanical properties

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