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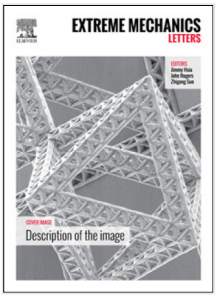

An exploration of the ballistic resistance of multilayer graphene polymer composites

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An exploration of the ballistic resistance of multilayer graphene polymer composites

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Abstract

The response of multilayer graphene / polyvinyl alcohol (MLG/PVA) films were studied under quasi-static (Q.S.) and dynamic, edge-clamped, transverse loading. The 10 μm thick films, reinforced by ~35 vol.% MLG and measuring 85 mm square, were fabricated by liquid exfoliation of the graphene followed by filtration of the MLG/PVA dispersion. The responses of the MLG/PVA films were compared with those of equal areal mass films of pure PVA and aluminum. The moderately conductive (~10^{-2} S cm^{-1}) MLG/PVA films had a Young's modulus approximately twice that of PVA and a low strain rate (10^{-3} s^{-1}) peak strength that was about 50% higher. Moreover, while the MLG/PVA films had a tensile strength lower than the Al films, they had a higher load carrying capacity compared to the Al films and were stiffer than the PVA films under Q.S. transverse loading. The ballistic limit of the MLG/PVA films was ~50% higher than the Al films, but the higher ductility of the parent PVA resulted in the pure PVA films having a higher ballistic resistance. The ballistic resistance of the MLG/PVA is well predicted by a membrane stretching analysis and this enables us to present an outlook on the ballistic resistance potential of graphene/PVA composites comprising aligned large flakes.

Keywords: Polymer-matrix composites; Graphene; Impact behavior; Mechanical properties.

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