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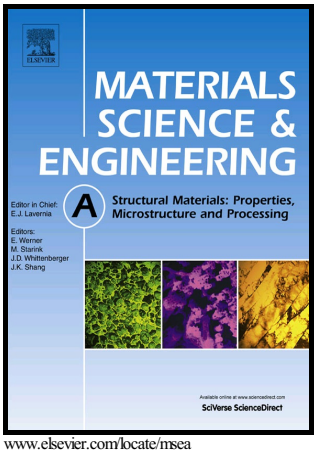

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Abstract

Current graphene/metal composites are mostly limited to the cases of using graphene oxide (GO) which contains a high level of defects. In this work, the high-quality graphene nanoplatelets (GNPs) were used as starting graphene material to prepare the GNP/Cu composite. Oxygen plasma treatment was employed to conduct the surface functionalization of GNPs by grafting the considerable oxygen-functional groups but without noticeably damaging the graphene structure. It was found that the plasma-treated GNPs (P-GNPs) exhibited not only a good dispersability in ethanol/water, but also an enhanced electrostatic affinity with Cu powder, resulting in the P-GNP/Cu composite with a uniform GNP distribution and a good interfacial bonding. At 1 vol.% GNP loading, the P-GNP/Cu composite presented a largely enhanced yield strength of 188 MPa with a relatively high failure elongation of 21%, significantly outperforming the composite with untreated GNPs (158 MPa, 12%). The enhanced strength could be explained by the load transfer mechanism and agreed approximately with the prediction of a modified shear-lag model. The good ductility was attributed to the prominent dislocation storage capability of P-GNP/Cu composite. Therefore, the oxygen plasma treatment provides a general and effective strategy to improve graphene distribution and mechanical properties of graphene/metal composites.

Keywords*:* Graphene/metal composites; Oxygen plasma treatment; Distribution; Interfacial bonding; Mechanical properties

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