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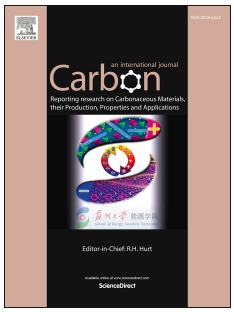

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Improvements in the Mechanical Properties of Carbon Nanotube Fibers through Graphene Oxide Interlocking

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Abstract

Carbon nanotubes (CNTs) have attracted remarkable attention due to their high mechanical performance and low density which are desirable for application as lightweight materials in automotive and aerospace industries to improve fuel efficiency. However, CNT fibers generally exhibit far lower mechanical properties (strength, toughness, etc.) than individual CNTs due to the weak interfacial shear strength between adjacent shells, nanotubes, and nanotube bundles, causing insufficient load transfer. In this study, to improve the interfacial shear strength of the fibers, graphene oxide (GO) was infiltrated into the CNT fibers to interlock CNT bundles. GO was selected due to its high mechanical properties and similar carbon-based structure as the CNT fibers. In addition, GO interfaces are known to exhibit higher frictional forces for sliding contacts than those found for pristine graphene sheets, which makes it more desirable for enhancing the shear interactions. GO particles with a width of ~40 nm, which match closely to the void size within fibers, were optimal for enhancing the mechanical properties of the CNT fibers. Tensile testing demonstrated optimized GO infiltrated CNT fibers exhibited improvement in: stiffness ~ 100%, yield strength ~ 110%, ultimate tensile strength ~ 56%, and energy to failure ~ 30% of pristine CNT fibers.

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