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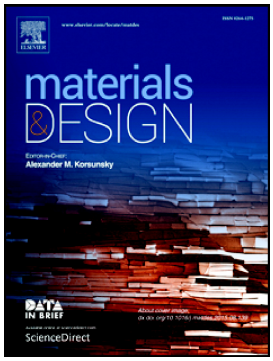

One-step purification of direct-spun CNT fibers by post-production sonication

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One-step purification of direct-spun CNT fibers by post-production sonication

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Abstract

Lightweight high-performance macroscopic fibers and yarns of oriented carbon nanotubes (CNTs) with high tensile strength and stiffness and electrical conductivities are in high demand for a wide range of applications. Among various production methodologies, the direct continuous spinning of CNT fibers from a chemical vapor deposition reactor has attracted interest because of its scalability potential. However, the presence of non-CNT impurities limits achieving high fiber tensile and electrical performances reproducibly. Here, we present for the first time a one-step protocol to purify direct-spun CNT fibers by mild sonication in acetone. Sonication reduced the impurity content by ~42%, which led to enhanced CNT fiber performance. In comparison to untreated fibers, the purified fibers showed a 50% and 100% increase in specific strength and stiffness, respectively. The CNT fiber electrical conductivity increased by 3-fold after purification. This improvement in fiber performance was observed despite a reduction in the nanotube bundle orientation after sonication. The better performance of the purified fibers is attributed to improved CNT bundle packing and densification. Our process is simple, quick, effective, and uses readily available acetone and hence, shows promise as a post-production purification method to direct CNT fiber spinning.

Keywords: Carbon nanotube fiber; direct spinning; sonication; tensile property; electrical conductivity

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