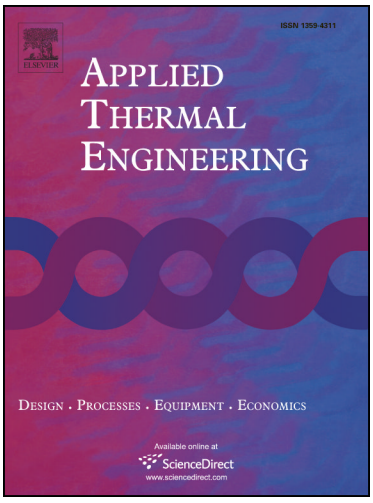

Iodine nanoparticle-enhancing electrical and thermal transport for carbon nanotube fibers

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Iodine nanoparticle-enhancing electrical and thermal transport for carbon nanotube fibers

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ABSTRACT The excellent electrical and thermal transport properties of individual carbon nanotubes (CNTs) have allowed them to stand out in nanoenergy and nanoelectronics applications. However, scaling them up from nanometer-sized tubes to micrometer assembled fibers generally leads to considerable electrical and thermal transport deterioration. In pursuit of a new strategy for boosting thermal and electrical transport, we experimentally confirmed that the intercalation of iodine (I) molecules can significantly raise the inter-tube interfacial electrical and thermal transport (IET and ITT), and thus boost the overall electrical and thermal transport performance of the fibers. The underlying mechanisms from an energy carrier standpoint are also explored and discussed. It is demonstrated that the introduced I molecules can invoke electron extraction from CNTs, which enhances the IET. The formed $(I_3)^-$ and $(I_5)^-$ polyiodide chains act as additional heat transfer channels and induce low-frequency phonons of the interfacial carbon atoms, and the intercalation also improves the matching level of the vibrational density of states at the inter-tube interface. These three-fold effects contribute to the ITT. Our findings are one step forward on the path towards advanced CNT-based functional materials with high electrical and thermal transport.

KEYWORDS: Carbon nanotube fiber · Electrical conductivity · Iodine nanoparticle-