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Three-dimensional tubular graphene/polyaniline composites as high-performance elastic thermoelectrics

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Abstract

Combining thermoelectric (TE) properties and elastic feature of organic materials will be unique and fascinating, which is difficult for traditional inorganic TE materials. However, organic materials with good elasticity always show poor electrical conductivity as well as low TE performance. Herein, we composite polyaniline (PANI) with three-dimensional tubular graphene (3D graphene) for high-performance elastic TE materials. It was found this method overcame the commonly encountered dispersing problem of graphene and therefore maximized the amount of the interfaces between graphene and PANI, which contributed to a relatively high Seebeck coefficient and low thermal conductivity. As a result, a maximum ZT value of 0.02 was achieved at room temperature in 55 wt% 3D graphene/PANI composite bulks, which was among the top level for PANI based composite TE bulks. Furthermore, the elastic composite bulks also exhibited mechanical-stable TE properties, with negligible performance change after 100 times 50% compression cycles. It is the first time to fabricate polymer based bulks with such excellent TE properties and elasticity to the best of our knowledge. This work demonstrates a new strategy for preparing high-performance elastic TE materials.

Keywords

Thermoelectric; Elastic properties; Nano composites; Polyaniline