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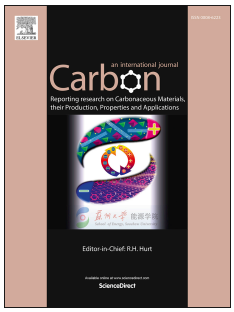

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Title

Spray Doping Method to Create a Low-Profile High-Density Carbon Nanotube Thermoelectric Generator

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Abstract

A new spray doping method is presented that allows for easily tunable thermoelectric properties of thin film carbon nanotube (CNT) polymer composites. An airbrush introduces small molecule Polyethyleneimine into existing p-type CNT films converting it to an n-type composite. This technique allows for the conversion of a single p-type film into a multi-section device of alternating p- and n-type segments. A thermoelectric generator (TEG) design is presented with the effort to address current design issues facing thin film thermoelectric devices as a commercially viable TEG. The Seebeck coefficient and electrical conductivity were tested under different dopant concentrations and compared with traditional solution based methods.

1. Introduction

Carbon nanotubes (CNTs) represent a large portion of organic thermoelectric research because of the range of methods that can improve the thermoelectric figure of merit *ZT*. Introducing CNTs into polymer blends can reduce thermal conductivity while at the same time remaining conductive through percolating networks [1]. Different functionalized CNTs can improve film integrity [2], Seebeck coefficient [3–5], and electrical conductivity [6]. Small molecules have been shown to dope CNTs to achieve higher Seebeck coefficients or even different majority charge carriers [7–10]. While these methods focus on improving *ZT*, the obstacles surrounding integration of thin film thermoelectrics into a functional thermoelectric generator (TEG) remain a concern in overall effectiveness.

Commercial bulk inorganic TEGs consisting of bismuth telluride (Bi_2Te_3) can easily achieve two basic design parameters necessary to optimize performance, however achieving the same with thin film devices is a challenge. First, the individual components need to be

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