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Electrical and Thermal Properties of Orientated Multiwall Carbon Nanotube Bulk Materials KEQIN YANG, Clemson University, JIAN HE, ZHE SHU, APPARAO RAO, DEPARTMENT OF PHYSICS AND ASTRONOMY; COMSET, CLEMSON UNIVERSITY, CLEMSON, SC, 29634 COLLABORATION
— Millimeter long vertically oriented multiwall carbon nanotube (MWNT) arrays with typical tube diameter around 30-50 nm were grown on Si substrates using thermal chemical vapor deposition. The arrays were realigned and densified using a spark plasma sintering process to form oriented MWNT bulk samples. Electron microscopy studies on the as-prepared bulk samples corroborate that the MWNTs are fairly well aligned and the pristine tubular morphology of the MWNTs is preserved during the sintering. The temperature dependent electrical, thermopower and thermal conductivity measurements were performed along different directions relative to the preferred orientation of MWNTs. In particular, the longitudinal and transverse thermal conductivity at 300 K are found to be about 35 W/(mK) and 1 W/(mK), respectively. In the temperature regime between 10 – 300 K, the electrical resistivity is on the order of few mΩcm and exhibits a thermal excitation type temperature dependence, while the Seebeck coefficient is on the order of few uV/K and exhibits a weak temperature dependence. These results give new insights into the unique electrical and thermal transport mechanisms in and between MWNTs.

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