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Tuning Bi2Te3 nanoparticles for high performance flexible thermoelectric nanogenerators

During the past few decades, with rapid enlargement of human society, consumption of traditional energy has increased exponentially. Thermoelectric materials (TE) can generate electrical energy when they are exposed to a thermal gradient, considered one of the most important solutions for sustainable energy harvesting.[1,2] These materials present lightweight, small size, pollution free and recycling potential.[2] One of the most used TEs is the alloy Bi2Te3 since it is considered as the best performing thermoelectrical material near room temperature (150-300 K).[2] The performance of a thermoelectric material is assessed by a dimensionless figure-of-merit, zT, defined as zT = S2σT/(κe + κl), where S, σ, κe, κl and T are the Seebeck coefficient, electrical conductivity, electronic and lattice thermal conductivities, and the absolute temperature, respectively. An average zT between 1.5–2 can enable substantial waste-heat harvesting and application in primary power generation.[3] Recently, in order to obtain high zT values, was developed Bi2Te3 nanomaterials leading thus a strong quantum confinement and a significant reduction of the lattice thermal conductivity, causing an increase of the zT value.[4]
Herein, it was prepared Bi2Te3 NPs using a chemical reduction process and a polyol to confine the NPs size.[5] The NPs were characterized by XRD, DLS, SEM and transport properties presenting a mix of Bi2Te3 with a small amount of Te, an average hydrodynamic diameter of 261±23 nm (PDI = 0.31±0.04, n = 5), S = +172.8 μV K-1 (being p-type material), σ = 22.20 S mm-1, and a Power Factor of 0.662 μW m-1 K-2.

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