ORGANIC-INORGANIC HYBRIDS: AN INNOVATIVE STRATEGY FOR THERMOELECTRIC POWER GENERATION AND WASTE HEAT RECOVERY

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Thermoelectricity is a current flow due to the temperature difference. Thermoelectric (TE) materials and devices can directly convert heat to electricity without moving parts. Common thermoelectric materials are solid-state devices, which limits their use to small areas due to constraints in manufacturing over larger scales. To address this limitation and enable broader applications, we present the development of hybrid organic-inorganic thermoelectric materials. These hybrids combine the advantages of organic polymers, such as flexibility and ease of processing, with the high thermoelectric efficiency of inorganic materials.

Here, we present the development of all solution-processed TE hybrid materials with varying content of nanostructured n and p-type TE materials Bi_2Te_3 and Sb_2Te_3. Large-area of hybrid TE films are fabricated using (PMMA) as a durable polymer and (MPA) as a solvent.

The electrical conductivity and Seebeck coefficient are measured for the hybrid TE materials. The power factor is calculated from 40% to 90% nanoparticle filler content. The conductivity and TE power factor improve with nanoparticle volume fractions. The peaking around 60-70% fill factors show the highest power factor values.

This innovative approach allows for the development of larger-area thermoelectric devices, opening up new possibilities for energy harvesting and waste heat recovery in various applications, including wearable electronics, flexible sensors, and large-scale energy harvesting systems.

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