

Ink processing for thermoelectric materials and modules

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Here, we present the shape-conformable thermoelectric materials geometrically to surfaces of any shape by securing the flexibility of thin films or painting and 3D printing processes. We synthesized the molecular Sb_2Te_3 and SnSe chalcogenidometallate and utilize them as ink solutions for fabricating flexible thin films. These thin films exhibited ZT values comparable to or even higher than the bulk values. At the same time, we prepared Bi_2Te_3 -based inorganic pastes by using Sb_2Te_3 chalcogenidometallate as an additive for Bi_2Te_3 -based thermoelectric particles, with ZT values of 0.5~0.7 for n-type and 1.0~1.2 for p-type materials that compete the bulk values. Devices directly brush-painted onto curved surfaces produced the high output power of 4.0mWcm^{-2} under the temperature difference of 50 °C. Also, the shapes of 3D blocks printed by dispensing process were controllably varied to cube, circle, and half ring. Half-ring shaped thermoelectric 3D blocks were used to fabricate the cylindrical power generating module with three n-type and p-type pairs, which exhibited mW-level power under the temperature difference of 30~40 °C.