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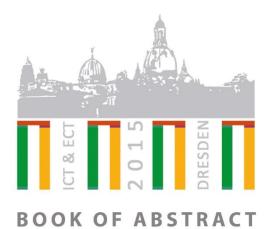
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8A.3

Optimization of spark plasma sintering conditions for antimony-doped bismuth telluride

<u>Li Han¹</u>*, Ngo Van Nong¹, Le Thanh Hung¹, Hoang Ngan Pham¹, Steeven Hegelund Spangsdorf¹, Aljoscha Roch², Lukas Stepien², and Nini Pryds¹

¹ Department of Energy Conversion and Storage, Technical University of Denmark, DTU Risø Campus, Frederiksborgvej 399, 4000 Roskilde, Denmark.
² Fraunhofer Institute for Material and Beam Technology (IWS), Winterbergstrasse 28, 01277 Dresden, Germany.
*e-mail of presenting author: ihan@dtu.dk

Antimony-doped bismuth telluride (Sb-doped Bi₂Te₃) is one of the best and most-used ptype thermoelectric materials for near-room-temperature application [1, 2, 3]. It has a stacked two-dimensional (2D) layered crystal structure, and exhibits the anisotropic thermoelectric properties [4]. In this work, we investigated the correlations between spark plasma sintering (SPS) conditions and the thermoelectric properties of Sb-doped Bi₂Te₃ samples. After sintered using SPS, the Sb-doped Bi₂Te₃ samples showed distinctive density, microstructure, and crystalline preferential orientation as the sintering conditions (temperature, pressure, and ramping rates) changed. Accordingly, different thermoelectric properties were also observed by these samples. An optimized sintering condition was found and an in-plane figure of merit ZT up to 1.3 at 298 K was achieved. Such high ZT was supported by the excellent in-plane electrical transport properties, which was mainly resulted from a high degree of cplane orientation. A high in-plane power factor of 4.79 ×10⁻³ W m⁻¹ K⁻² was shown compared with the out-of-plane value of only 2.76 ×10-3 W m-1 K-2. On the other hand, the micronscaled grains along the in-plane directions were resulted from SPS sintering; these grains are very effective to scatter acoustic phonons while giving minor harm to electrical transport. This work gives an insight for manipulating the spark plasma sintering conditions and anisotropic thermoelectric properties of Sb-doped Bi₂Te₃.

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