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Structure and thermoelectric properties of $In_xBa_yCo_4Sb_{12}$ samples prepared by HPHT

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Abstract: Double-filled $CoSb_3$ is one kind of the most promising thermoelectric materials, the choice and concentration of filled atoms are the key for the high figure of merit values (ZTs). We report the transport properties of In and Ba filled skutterudite perepared by a high-pressure synthesis approach, the processing time was sharply reduced from a few days to half an hour. The main parameters, including Seebeck coefficient, electrical resistivity and thermal conductivity, were all investigated in the temperature range of 323-723 K. $In_{0.4}Ba_{0.1}Co_4Sb_{12}$ showed a relatively good ZT value attributed to both the enhanced power factor and the low thermal conductivity. And the multiple microstructures, defects and strains were also revealed by high-resolution transmission electron microscopy (HRTEM) images.

Keywords: Skutterudite; Thermoelectric properties; HPHT; Seebeck coefficient

1. Introduction

A large number of researches have focused on thermoelectric technology for nearly three decades due to the increasing demand of energy and the desire for improved efficiency [1-5]. The coefficient of performance for a thermoelectric cooler or the conversion efficiency of a thermoelectric generator depend on the dimensionless figure of merit, which is defined as $ZT=\alpha^2\sigma T/\kappa$ [6-11], where α is Seebeck coefficient, σ is electrical conductivity, κ is thermal conductivity and T is the temperature in Kelvin. Generally, κ is the sum of electronic thermal conductivity κ_e and the lattice thermal conductivity κ_{ph}.

$CoSb_3$ materials are considered as one of the most promising middle temperature thermoelectric materials for automotive thermoelectric waste heat recovery, due to their small band gap, high carrier mobility and modest thermopower. Although $CoSb_3$ materials have many advantages, high thermal conductivity is still hindering its

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