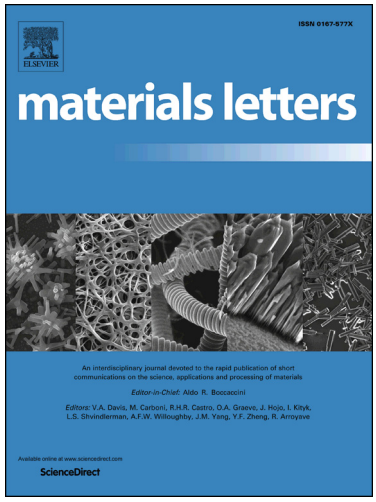

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PII: S0167-577X(17)30924-2
DOI: http://dx.doi.org/10.1016/j.matlet.2017.06.037
Reference: MLBLUE 22749

To appear in: *Materials Letters*

Received Date: 9 May 2017
Revised Date: 30 May 2017
Accepted Date: 7 June 2017

Please cite this article as: L. Deng, J. Ni, J. Qin, X. Jia, Enhancement thermoelectricproperties of In-filled and Te-doped $CoSb_3$ synthesized by high pressure technique, *Materials Letters* (2017), doi: http://dx.doi.org/10.1016/j.matlet.2017.06.037

Enhancement thermoelectric properties of In-filled and Te-doped $CoSb_3$ synthesized by high pressure technique

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Abstract: Bulk In-filled and Te-doped $CoSb_3$ materials have been synthesized by high pressure and high temperature (HPHT) method directly. XRD and SEM images showed that $In_{0.3}Co_4Sb_{11.5}Te_{0.5}$ with fine grain sizes could be quickly synthesized by HPHT, use only half an hour. HRTEM observation revealed the different kinds of defects in the high pressure synthesized samples. The different synthesis pressures dramatically reduced the lattice thermal conductivity due to enhance the multiple microstructures and defects phonon scattering effects, and simultaneously enhanced the Seebeck coefficient. Finally, the figure of merit (ZT) values of samples increased with the increase of synthesis pressures.

Keywords: Electrical properties; Thermoelectric properties; HPHT; Thermal properties

1. Introduction

With the increasingly serious of global energy crisis, new energy materials and devices have gradually become a new research hotspot [1-3]. And, the researches on thermoelectric (TE) materials have been mainly concentrated on improving the ZT values to increase the power efficiency of the device for application. The figure of merit ZT is defined as $ZT=\alpha^2\sigma T/\kappa$ [4-6], where α, σ, T and κ respectively represent the Seebeck coefficient, electrical conductivity, temperature in Kelvin and thermal conductivity.

Skutterudite $CoSb_3$ materials exhibit attractive transport properties for their small band gap, high carrier mobility and modest thermopower. However, the high thermal conductivity has seriously affected its practical application in the field of devices. So, many studies about skutterudite materials have focused on how to reduce the lattice thermal conductivity [7, 8]. In general, there are two effective ways to reduce the lattice thermal conductivity, including: (1) the lattice thermal conductivity could be

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