Anisotropic thermal conductivity of sputtered Bi0.5Sb1.5Te3 films after current-assisted thermal treatment

Jen-Chuan Hsiao, Yao-Hsiang Chen, Chien-Neng Liao

PII: S0040-6090(17)30769-1
DOI: doi:10.1016/j.tsf.2017.10.019
Reference: TSF 36287

To appear in: *Thin Solid Films*

Received date: 10 July 2017
Revised date: 5 October 2017
Accepted date: 9 October 2017

Please cite this article as: Jen-Chuan Hsiao, Yao-Hsiang Chen, Chien-Neng Liao , Anisotropic thermal conductivity of sputtered Bi0.5Sb1.5Te3 films after current-assisted thermal treatment. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Tsf(2017), doi:10.1016/j.tsf.2017.10.019

Anisotropic thermal conductivity of sputtered $Bi_{0.5}Sb_{1.5}Te_3$ films after current-assisted thermal treatment

Jen-Chuan Hsiao[a], Yao-Hsiang Chen[b], Chien-Neng Liao[b,*]

[a] Department of Physics, National Tsing Hua University, Hsinchu 30013, Taiwan

[b] Department of Materials Science and Engineering, National Tsing-Hua University, Hsinchu 30013, Taiwan

Abstract

Rhombohedral bismuth telluride exhibits highly anisotropic transport properties in different crystallographic directions. Although the degree of anisotropy is diminished in polycrystalline solids, the development of crystallographic texture will lead to distinct thermoelectric properties in the in-plane and out-of-plane directions of thin films. In this study, both in-plane and out-of-plane thermal conductivities of sputtered $Bi_{0.5}Sb_{1.5}Te_3$ (BST) films subjected to thermal/electrical treatments were measured experimentally by the two-wire 3-omega method. The in-plane thermal conductivity of the electrically treated sample is nearly twice as high as that of the thermally treated sample, which is mainly attributed to the enhanced (00*l*) film texture of the electrically treated BST film. The understanding of anisotropic thermal transport behavior shall help the design and performance modeling of BST-based thermoelectric thin film devices.

Keywords: thermoelectric; heat conduction; crystal structure; anisotropy; sputtering; texture.

Corresponding author: Chien-Neng Liao, e-mail: cnliao@mx.nthu.edu.tw