Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data article

Synthesis and thermoelectric properties of InSb alloys by solid reaction

Kang Wang, Peng Qin, Zhen-Hua Ge^{*}, Jing Feng

Faculty of Materials Science and Engineering, Kunming University of Science and Technology, China

ARTICLE INFO

Article history:

Received 18 August 2017

Received in revised form

12 November 2017

Accepted 23 March 2018

Available online 30 March 2018

ABSTRACT

The data presented in this article are related to the research article entitled "Synthesis and thermoelectric properties of InSb alloys by solid reaction" (Kang Wang, Peng Qin, Zhen-Hua Ge, Jing Feng, 2017) [1]. This article describes a new strategy of eutectic melting for improving the TE properties. We put the powders of In and Sb (both is 200 mesh) with a certain proportion of InSbx ($x = 1.0, 1.01, 0.99, 0.97$ and 0.95) and sealed them in different crucibles (23 mm $\times$ 18 mm).

© 2018 Published by Elsevier Inc. This is an open access article under the CC BY license

(<http://creativecommons.org/licenses/by/4.0/>).

Specifications Table

Subject area	Chemistry
More specific subject area	Thermoelectric materials
Type of data	Table, image (x-ray, microscopy), figure
How data was acquired	X-ray diffraction, EPMA, SEM
Data format	filtered, analyzed
Experimental factors	Put In powder and Sb powder in a certain proportion of InSbx ($x = 1.0, 1.01, 0.99, 0.97$ and 0.95) and sealed in different crucibles (23 mm $\times$ 18 mm).

DOI of original article: <https://doi.org/10.1016/j.matlet.2017.08.009>

^{*} Corresponding author.

E-mail addresses: zge@kmust.edu.cn, 457288313@qq.com (Z.-H. Ge), jingfeng@kmust.edu.cn (J. Feng).

<https://doi.org/10.1016/j.dib.2018.03.108>

2352-3409/© 2018 Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Experimental features	The samples were melted at 973 K for 3 h under purified argon atmosphere in a tube furnace, then the furnace was cooling down to room temperature at the rate of 20°C/min.
Data source location	Kunming, China for collected samples/data if applicable
Data accessibility	The data are available with this article

Value of the data

- The data presents the specific experimental process.
- The details of the experiment, test methods and instrument models.
- The data shows that the temperature dependence of the lattice thermal conductivity.

1. Data

The dataset of this article provides the sample preparation process information. The Fig. 1 show the temperature dependence of the lattice thermal conductivity of the InSb sample with different x contents. Table 1 shows the density of the InSb sample with different x contents.

2. Experimental design, materials and methods

The InSb _{x} samples with different x values ($x = 1.01, 1.0, 0.99, 0.97$ and 0.95) were prepared by using the In, Sb, (99.9% in purity) powders. We put the powders of In and Sb (both is 200 mesh) with a certain proportion of InSb _{x} ($x = 1.0, 1.01, 0.99, 0.97$ and 0.95) and sealed them in different crucibles (23 mm $\times$ 18 mm). Then delicately placed the crucibles into quartz tubes. The samples were heated from room temperature to 973 K with the pressure at 5×10^{-2} Pa under purified argon atmosphere in 30 min. Then samples were melted at 973 K for 3 h and the furnace was cooling down to room temperature at the rate of 20°C/min. Finally, we obtained the cylindrical specimens with the size of 16 mm $\times$ 5 mm.

The specimens were characterized by X-ray diffraction (XRD: Cu-K α Bruker D8, Germany) and the density (ρ) of the samples were determined by Archimedes method. The fractographs were measured by a field emission scanning electron microscope (SEM, ZEISS, EVO18-21-57), and the composition identification was conducted by electron probe microanalysis (EPMA; Rigaku, Tokyo, Japan) on a JEOL JXA-8230 microscope. To measure electrical conductivity and Seebeck coefficient, the samples were

Fig. 1. Temperature dependence of the lattice thermal conductivity of the InSb sample with different x contents.

Table 1The density of the InSb sample with different x contents.

	InSb _{1.01}	InSb	InSb _{0.99}	InSb _{0.97}	InSb _{0.95}
$\rho(\text{g/cm}^3)$	5.75	5.717	5.706	5.697	5.689

cut from the sintered pellets into rectangular bars with a dimension of $1 \times 3 \times 10$ mm. The Seebeck coefficient and electrical resistance were measured using a Seebeck Coefficient/Electrical Resistance Measuring System (ZEM-3, UlvacRiko, Japan) in a helium atmosphere. The thermal diffusivity (D) was measured by laser flash method (NETZSCH, LFA457, Germany). The thermal conductivity (κ) was calculated by the density (ρ), specific heat and thermal diffusivity using the equation $\kappa = DC_p\rho$. These thermoelectric properties were measured in the temperature range of 323–773 K.

The temperature dependences of κ_l and κ_c for the InSb samples and of κ_l for InSb are shown in Fig. 3d and Fig. 1. The lattice thermal conductivity κ_l was estimated by subtracting the carrier thermal conductivity κ_c from κ using the Wiedemann–Franz relationship $\kappa_c = L\sigma T$, where L is the Lorentz number [2,3].

This work mainly adopted the strategy of eutectic melting to prepare InSb type alloy thermoelectric material. Using solid reaction to prepare eutectic compounds not only can prepare lamellar InSb alloy, but also this method is efficient and simple. Furthermore, the thermoelectric properties of the alloy could be improved by doping and changing the experimental conditions.

Transparency document. Supplementary material

Transparency data associated with this article can be found in the online version at <https://doi.org/10.1016/j.dib.2018.03.108>.

References

- [1] Kang Wang, Peng Qin, Zhen-Hua Ge, Jing Feng, Synthesis and thermoelectric properties of InSb alloys by solid reaction, *Mater. Lett.* 209 (2017) 373–375.
- [2] K. Huang, *Solid State Physics*, Higher Education Press, Beijing (2000) 50e69.
- [3] D.P. White, P.G. Klemens, Thermal conductivity of thermoelectric $\text{Si}_{0.8}\text{-Ge}_{0.2}$ alloys, *J. Appl. Phys.* 71 (1992) 4258.