Accepted Manuscript

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PII: S0925-8388(18)33126-8

DOI: 10.1016/j.jallcom.2018.08.238

Reference: JALCOM 47326

To appear in: *Journal of Alloys and Compounds*

Received Date: 24 April 2018

Revised Date: 23 July 2018

Accepted Date: 24 August 2018

Please cite this article as: Y. Huang, H. Nagai, K. Hayashi, Y. Miyazaki, Preparation and thermoelectric properties of pseudogap intermetallic $(Ti_{1-x}V_x)NiSi$ solid solutions, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.08.238.

Preparation and Thermoelectric Properties of Pseudogap Intermetallic ($Ti_{1-x}V_x$)NiSi Solid Solutions

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Abstract

We theoretically and experimentally investigated the thermoelectric (TE) properties of TiNiSi-based solid solutions with a pseudogap at the Fermi level in the electronic band structure. Calculation of the TE properties of TiNiSi predicted that electron doping of TiNiSi leads to a higher power factor than hole doping. According to this prediction, we prepared the partially V-substituted TiNiSi-based compounds ($Ti_{1-x}V_x$)NiSi (x = 0, 0.05, 0.10, 0.15, and 0.20) using arc-melting and subsequent spark plasma sintering. An increase in the V content x improved the n-type TE properties: the absolute values of the Seebeck coefficient and electrical conductivity both increased, while the thermal conductivity slightly decreased. The highest dimensionless figure-of-merit, zT, was 0.032 at 600 K, obtained for the x = 0.20 sample.

Keywords: TiNiSi-type compound; thermoelectric property; pseudogap; electronic structure

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1. Introduction

Thermoelectric (TE) conversion technologies have recently attracted much attention as potential clean energy harvesting techniques because heat energy is directly converted into electricity using