Effect of Ag on the Thermoelectric Properties of Ag2Se Alloy Prepared by Mechanical Alloying Process

Wang Kee Min[1], Sung Doo Hwang[1], Yeong Do Park[2], Yong Ho Park[1], Ik Min Park[1]

[1]Division of Materials Science and Engineering, Pusan National University, Korea
[2]Dept. of Advanced Materials Engineering, Dong-Eui University, Korea

Abstract

The thermoelectric properties of Ag2Se and excess Ag alloys synthesized by mechanical alloying process were studied. The X-ray diffraction patterns show that most all of the samples crystallize in orthorhombic structure. In the case of Ag2Se alloy, the peak due to pure Ag is not observed almost all. A peak corresponding to pure Ag (111) plane was observed in all the Ag excess samples. The Seebeck coefficient (S) of all materials was negative value, which indicates that all prepared materials are n-type materials. The absolute S value slightly decreased with the Ag content. Contrary to that, the electrical conductivity (σ) increased with Ag content. This was due to the increased carrier concentration supplied by the excess Ag clusters. Below 280K, the σ value of the excess Ag alloys is almost constant regardless of temperature, which means that the Ag excess alloys is highly degenerated. At higher temperatures above 290 K, the intrinsic conduction behavior for all materials is observed and the band gap energy for Ag2Se calculated from the slope of curve in this higher temperature range is about 220 meV. The figure of merit value (Z) was increased by the excess Ag, from 0.28/K (Ag2Se) to 0.91/K (Ag2.05Se1.95).