Chapter 5

Conclusion

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Thermoelectric materials

The $Mn_{1-x}Ag_xSi_{1.75-y}Bi_y$ (x = y = 0, 0.01, 0.02, 0.03, 0.04 and 0.05) materials were successfully synthesis by ball milling and hot press method. The XRD pattern of all samples show mixes phase between $MnSi_{1.75}$ for main phase and MnSi for secondary phase. The main phase is shows tetragonal structure with P-4n2 (118) of space group. The relative density of all samples shows higher than 92%. The elemental mapping of all samples shows homogenous distribution of Mn, Si, Ag and Bi. The EDS results show agree with the composition of initial atomic ratio. The Seebeck coefficient of doped samples are show all higher than undoped sample. The highest of S value reveal by $Mn_{0.98}Ag_{0.02}Si_{1.73}Bi_{0.02}$ sample about 119 $\mu V K^{-1}$ at 673 K. The doped samples with x value effect to insignificant increase electrical resistivity. The $Mn_{0.98}Ag_{0.02}Si_{1.73}Bi_{0.02}$ sample reveal highest power factor about 3.97×10^{-4} $Wm^{-1}K^{-2}$ at 673 K, which represents a more than 45.35 % enhancement in comparison to the non doped $MnSi_{1.75}$ sample.

The $Mg_{2-x}Ag_xSi_{1-y}Bi_y$ (x = y = 0, 0.01, 0.02, 0.03, 0.04 and 0.05) materials were successfully synthesis by ball milling and hot press method. The XRD pattern of all samples show cubic structure and corresponded with PDF Card number 00-035-0773. Bulk density of $Mg_{2-x}Ag_xSi_{1-y}Bi_y$ samples were increasing with increasing x and y values while relative density decreased. The EDS results show agree with the composition of initial atomic ratio. The Seebeck coefficient of doped samples at 773 K show all higher than undoped sample. The highest of S value reveal by $Mg_{1.98}Ag_{0.02}Si_{0.98}Bi_{0.02}$ sample about -285.37 $\mu V K^{-1}$ at 773 K. The $MnSi_{1.75}$ doded with x values were reduced electrical resistivity. The

$Mg_{1.95}Ag_{0.05}Si_{0.95}Bi_{0.05}$ bulks sample shows lowest value of electrical resistivity about 3 mΩ cm at 773 K. The Ag and Bi doped on Mg_2Si effect to enhancing power factor and $Mg_{1.95}Ag_{0.05}Si_{0.95}Bi_{0.05}$ bulks sample shows highest power factor about 20.27 mW cm^{-1} K^{-2}.

Thermoelectric devices

The 1 pair, 11 pairs and 30 pairs of thermoelectric devices were fabricated using p- $Mn_{0.98}Ag_{0.02}Si_{1.73}Bi_{0.02}$ and n-$Mg_{1.95}Ag_{0.05}Si_{0.95}Bi_{0.05}$ by soldering method and exhibit resistance about 2.2 Ω, 21 Ω and 55 Ω, respectively. The measurement power output was used matching load of 2 Ω for 1 pair, 20 Ω for 11 pairs and 50 Ω for 30 pairs. The 1 pair, 11 pairs and 30 pairs of thermoelectric devices show the maximum electrical power about 0.08 mW, 1.29 mW and 4.08 mW at different temperature 140 K, respectively. The electrical power of 11 pairs and 30 pairs show higher than 1 pair about 14.43 and 45.51 times confirm that, the thermoelectric materials and electrode related to good contact. The surface temperature of all devices was slightly decreased when increasing electrical voltage. The 1 pair, 11 pairs and 30 pairs show maximum surface temperature decreased about 0.05 K, 0.09 K and 0.17 K, respectively. The thermoelectric devices of p-$Mn_{0.98}Ag_{0.02}Si_{1.73}Bi_{0.02}$ and n-$Mg_{1.95}Ag_{0.05}Si_{0.95}Bi_{0.05}$ is not suitable for thermoelectric refigulator application but it is postibility to thermoelectric generator application.

Suggestions

1. The materials synthesis should be prepared in gove box for decreasing oxide impurity on structure which interested in study effecting to thermoelectric properties.

2. The thermal conductity of thermoelectric materials should be measured by Laser flash analysis for determine dimensionless figure of merit and conversion efficiency.