CHAPTER 5

CONCLUSIONS AND SUGGESTIONS

In this chapter is conclusion of Ag-Sb-Te films deposited by DC magnetron sputtering system. Conclusion and suggestions based on the finding of this thesis are as follow :

CONCLUSIONS

In this work, Ag-Sb-Te films on Polyimide substrate were synthesized by dc-magnetron sputtering method along with the AgSbTe target purity of 99.99%. The deposition performed under Argon atmosphere at flow-rate of 30 sccm, base-pressure at 3.2×10^{-5} T, work-pressure at 2.5×10^{-2} T, the electrical current of 100±3 mA, voltage sputtering of 518±3 V, and power sputtering of 50 W. The as-deposited films were annealed at 300, 350, 400, 450 and 500°C in a high vacuum state for 30 min. The crystal structure and atomic composition were analyzed by XRD and EDX. The morphology and roughness were studied from the surface images with a high-resolution FE-SEM and AFM. The electrical resistivity and Seebeck coefficient were measured by the ZEM-3 at room temperature and were contributed to calculating the power factor.

The XRD results showed that the as-deposited film has amorphous. The annealed film at 300 and 350°C exhibited the mixed-phase of rhombohedral Sb_2Te_3, cubic Ag_2Te, and cubic $AgSbTe_2$. The annealed film at 400°C showed mixed-phase of cubic Ag_2Te and $AgSbTe_2$. In addition, the annealed films at 450 and 500°C showed cubic Ag_2Te only. The EDX analysis revealed that the Sb has losses at the annealing process at 450 – 500°C. The SEM image showed that the morphology of films deteriorated and increased the porosity with increasing the annealing temperature. The AFM image shows that the as-deposited was the roughness of 0.69 nm and annealed film at 300, 350, 400, 450, and 500°C have the roughness of 1.35, 2.82, 15.09, 16.08 and 17.57 nm, respectively. The carrier concentration was gradually decreasing with annealing temperature increasing. In contrast, the carrier mobility

increases greatly up to an annealing temperature of 450 °C and rapidly decreases when the annealed temperature approaches 500 °C. The decrease of the concentration can be attributed to the decrease of Sb element leading to deterioration of the thin films and decrease of carrier scattering at the grain limits during the annealing process. The annealed film at 350°C exhibits good thermoelectric properties with the Seebeck coefficient, electrical resistivity and power factor values of 186 μ V K^{-1}, 35.6 μ Ω m^{-1} and 971 μ W m^{-1} K^{-2}, respectively. To measure the performance of the thermoelectric generator, the output circuit voltage (V_{oc}) value for all films increased at a different temperature. The output voltage of an annealed film value at 350°C was more than all film with the different temperature of 20°C. The output power of all films was a slight increase with increasing electric current. After that, the output power decreased at thermal saturation point. While, the maximum output power of 0.88 nW obtained for annealing temperature at 350°C.

SUGGESTION

1. Should be reduce problem connection of terminal electrode.

2. For efficiency of output power, should be control the stability of different temperature.