近接昇華法による $AgGaTe_2$ 成長中 Ag_2Te 層表面形態変化の分析

The surface morphology change analysis of Ag_2Te layers in the two-step closed space sublimation process of $AgGaTe_2$

早大先進理工 [1]，早大材研 [2] ○余　洋 [1]，小林 正和 [1, 2]

Waseda Univ. Dept. of Elec. Eng. and Biosci. [1], Waseda Univ. Lab. for Mat. Sci. & Tech. [2],

○Yang Yu[1], and Masakazu Kobayashi[1,2]

E-mail: yoyou@fuji.waseda.jp

$AgGaTe_2$ is a promising photovoltaic material available for using in high-efficiency solar cells. The growth of crystallized $AgGaTe_2$ thin films by the two-step closed space sublimation (CSS) method has been successfully demonstrated [1]. For the two-step CSS of $AgGaTe_2$ thin films, an Ag_2Te buffer layer was first deposited on a Mo/glass substrate by RF sputtering method. Then, the preparation of $AgGaTe_2$ films was performed using a mixed powder source of Ag_2Te and Ga_2Te_3 [2]. In this study how the Ag_2Te buffer layer surface morphology was changed during the second CSS step.

The Ag_2Te layer was deposited on Mo/glass substrates by the RF sputtering method (the thickness was 0.1–0.3 μm). Ag_2Te films were annealed in a tube furnace without depositing the material. We performed comparative experiments by changing the annealing temperature and time. The annealing temperature was varied from 400 °C to 600 °C with annealing time of 15 min to 75min. The surface morphological characterization was performed using an optical microscope. (VHX-5000, Keyence, Japan). The crystallographic properties were evaluated by a standard θ–2θ measurements using XRD (Smart Lab, Rigaku, Japan). The layer exhibited a smooth surface before annealing, but this was changed after the annealing. Figure 1 shows optical microscopy images of Ag_2Te layers with varying the annealing temperature from 400 °C to 600 °C. The Ag_2Te layer exhibited small holes randomly distributed on the surface at 400 °C to 500 °C. The Ag_2Te layer surface exhibited a rugged and hollow film structure after annealing at 600 °C. Above 45 minutes of annealing, MoO_3 peaks were observed from XRD result. Dewetting process of Ag_2Te layer on Mo/glass substrate was observed for annealing at 400 °C ~500 °C. Dewetting process of these holes gradually became larger and the density of the holes with increasing the annealing temperature.

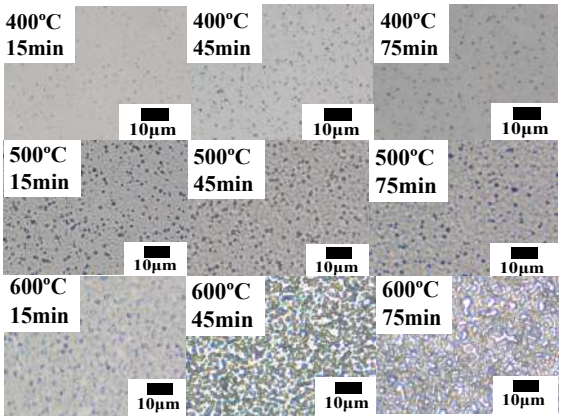

Figure 1 Optical microscopy images of Ag_2Te layers with varying the annealing temperature from 400℃ to 600℃ with annealing time of 15min to75min

References

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