The Effect of High Temperature Selenization by Sputtered CZTSSe thin films

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An ideal thin-film solar cell absorber material should have a direct band gap around 1.3–1.5 eV with abundant, inexpensive, and nontoxic elements $Cu_2ZnSnS_xSe_{4-x}$ (CZTSSe) is one of the most promising thin-film solar cell materials [1-2]. CZTSSe thin film solar cell is a promising absorber materials from the perspective of the industrialization of mass-produced and it is eco-friendly. Meanwhile, it is reported that best efficiency of CZTSSe thin film solar cells is 11.1 % using a hydrazine [4]. But it is low compared with CIGS efficiency, 20.3 %. Therefore, the problems about a material of CZTSSe which are decomposition during annealing, control of secondary phase formation, and film/device characterization are needed to improve. High temperature annealing process can improve the absorber grain size, crystallinity and the electric characteristics. But high temperature annealing process above 600℃ is impossible due to the transition point of soda-lime glass (573℃). In this study, CZTSSe solar cell was selenized above 600℃ using the substrate with high transition point (above 700℃). We examined the correlations between the annealing temperature and the device characteristics. As the annealing process temperature increases, the crystallinity of the absorber layer improved.

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