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Selenization dependence of morphological, structural and electrical properties of Cu2ZnSn(S,Se)4 thin films deposited by one-step sputtering

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Abstract content
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Cu2ZnSn(S,Se)4(CZTSSe), a promising absorber material in solar cells, was prepared on Mo/glass substrate by using an environmental friendly and cost-effective process from a self-prepared single ceramic target. Successive selenization for the as-deposited film by radio frequency (RF) magnetron sputtering at a substrate temperature of 200 oC was performed at various temperatures between 400 ℃ and 600 ℃ for 1 h without using polluting chemicals or toxic gas. Hall measurements indicated that the as-doposited and selenized films were p-type semiconductor behavior. An improved grain size and crystal quality obtained for CZTSSe film annealed at 600 ℃. The hole concentration increased from 1.06 to 2.4 × 1017 cm−3; the hole mobility increased from 2.82 to 6. 9 cm2V-1s-1; and resistivity decreased from 20.92 to 3.7 Ωcm as the precursor film selenized to 600 oC. Both variations can be ascribed to the larger grains with better crystallinity and decreased grain boundary density in the annealed film at 600 ℃. An enhanced hole mobility is also important for the cell performance.

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