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## Selenization dependence of morphological, structural and electrical properties of $\text{Cu}_2\text{ZnSn}(\text{S},\text{Se})_4$ thin films deposited by one-step sputtering

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**Abstract content** <br> &nbsp; (Max 300 words)<br><a href="http://events.saip.org.za/getFile.py/target="\_blank">Formatting &<br>Special chars</a>

$\text{Cu}_2\text{ZnSn}(\text{S},\text{Se})_4$  (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 °C was performed at various temperatures between 400 °C and 600 °C for 1 h without using polluting chemicals or toxic gas. Hall measurements indicated that the as-deposited and selenized films were p-type semiconductor behavior. An improved grain size and crystal quality obtained for CZTSSe film annealed at 600 °C. The hole concentration increased from 1.06 to  $2.4 \times 10^{17} \text{ cm}^{-3}$ ; the hole mobility increased from 2.82 to 6.9  $\text{cm}^2\text{V}^{-1}\text{s}^{-1}$ ; and resistivity decreased from 20.92 to 3.7  $\Omega\text{cm}$  as the precursor film selenized to 600 °C. Both variations can be ascribed to the larger grains with better crystallinity and decreased grain boundary density in the annealed film at 600 °C. An enhanced hole mobility is also important for the cell performance.

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