Deposition of CZTS|ZnO Hetero-Junction Using SILAR and Spray Pyrolysis

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Copper zinc tin sulphide (CZTS) thin films have been deposited on glass substrate at 323 ± 5 K using sequential ionic layer adsorption reaction (SILAR). The number of SILAR cycles required for optimum crystalline quality CZTS thin films was optimized. The as-deposited CZTS thin films showed kesterite crystalline structure with preferential orientation along (103) plane. Structural, optical, electrical, and morphological properties of the films changed when the as-prepared films were subjected to annealing in a vacuum chamber maintained at $3 \cdot 10^{-4}$ Torr at temperatures of 473, 573, and 673 K. Film resistivity was found to decrease exponentially as the annealing temperature was increased. We have achieved a resistivity of $4.4 \cdot 10^{-4}\,\Omega \cdot$ m for the as-prepared thin film, which is lowest among SILAR-grown films at temperature lower than 373 K without any post-deposition processing. A superstrate-type $p-n$ junction was fabricated by growing nano-structured zinc oxide (ZnO) on top of the glass|CZTS structure using chemical spray pyrolysis technique. The photosensitivity of the $p-n$ junction was reversed when the structure was subjected to vacuum annealing at 673 K.

Keywords: SILAR, CZTS, vacuum annealing, photo-sensitivity.

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