Vibrational and optical properties of CZTS derivatives for photovoltaic applications: Synthesis of Cu2ZnSn1-xGexS2Se2 compounds

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 Herein, we report the vibrational and optical properties of new Cu2ZnSn1-xGexS2Se2 solid solutions prepared by isomorphic substitution of a fraction of Se by S in Cu2ZnSn1-xGexSe4 (CZTGeSe) through ceramic method. The Raman spectra and x-ray diffraction analysis on samples confirms that they crystallize in Kesterite-type structure. The Raman peaks were analyzed by fitting of the spectra allowing identification the vibrational modes by comparison with experimental and theoretical data from CZTGeSe and CZTGeS end-members. The dependency between the amount of cation and chalcogen substituent in optical characterization shows band gap around of 1.36 eV, close to the optimum value for solar cells with high efficiency.