**Wide band-gap tuning Cu2ZnSn1-xGexS4 single crystals: optical and vibrational properties**

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**Abstract.** The linear optical properties of Cu2ZnSn1−xGexS4 high quality single crystals with a wide range of Ge contents (x=0.1, 0.3, 0.5, 0.7, 0.9 and 1) have been investigated in the ultraviolet and near infrared range using spectroscopic ellipsometry measurements. From the analysis of the complex dielectric function spectra it has been found that the bandgap E0 increases continuously from 1.49 eV to 2.25 eV with the Ge content. Furthermore, the evolution of the interband transitions E1A and E1B has been also determined. Raman scattering using three different excitation wavelengths and its analysis have been performed to confirm the absence of secondary phases in the samples, and to distinguish between stannite, wurtzite, wurzstannite and kesterite structures. Additionally, the analysis of the high resolution Raman spectra obtained in samples with different [Ge]/([Ge]+[Sn]) ratios allows describing a bimodal behavior of the dominant A modes. The understanding of the incorporation of Ge into the Cu2ZnSnS4 lattice is fundamental in order to develop efficient bandgap engineering of these compounds towards the fabrication of kesterite based solar cells with enhanced performance.

**Keywords:** Cu2ZnSn1−xGexS4, single crystals, bandgap, Raman spectra, lattice parameter.

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