Physical Characterization of thin films of $Cu_xZn_yS_z$ for photovoltaic applications

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The pseudoternary Cu_2FeSnS_4 (stannite) - Cu_3SnS_4 (kuramite) - Cu_2ZnSnS_4 (kesterite) system attracts a large interest due the physical properties associated to some of its terms. Namely, kesterite and, to a minor extent, kuramite and stannite are considered promising materials for energy conversion devices (photovoltaic applications), encompassing reduced production costs and low environmental risks.
The Electrochemical Atomic Layer Epitaxy (ECALE) [1] method was used to obtain compound semiconductors, in the form of thin films, whose composition belongs to the fields of kuramite and kesterite. In parallel, we obtained reference materials in the same compositional fields, by different solvothermal approaches. Nanocrystalline powders of several pure and mixed terms of the pseudoternary system were thus obtained by mild approaches.
Namely, structural, morphological and chemical characterisation were carried out by XRPD, SXRD, SEM and TEM, whereas magnetic susceptibility measurements, EPR, XAS, Mössbauer Spectroscopy and DRS provided an overall framework of the metal cations distribution and valences.
In this contribution, we will emphasize the role of transition metal cations in modulating the overall properties of both thin layer a nanoparticle materials, with specific reference to the structure, the morphology and the band gap. This, in turn, being close to that of kesterite, opens interesting perspectives in the chemical tuning of the photovoltaic properties.

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