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Electrodeposition of ternary system: from fundamentals to photovoltaic applications.

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The task for renewable energy resources is stimulating the research for new materials allowing to set up low cost and high conversion efficiency solar cells. Lowering the costs of raw materials, as well as increasing attention paid to the environmental consequences of the industrial production, both drive the development and the choice of materials on the basis of their chemical composition. The kesterite-like quaternary chalcogenides (Cu_2ZnSnS_4, or CZTS) attracted a relevant interest from worldwide researchers, due to their good performances with a simple chemistry and to the absence of relevant economic or environmental concerns associated to their use in the solar cells production.

The crystal chemical features of both natural and synthetic phases belonging to the pseudoternary system Cu_2FeSnS_4-Cu_2ZnSnS_4-Cu_3SnS_4, to which the CTZS materials belong, still awaits a definitive assessment. We approached the growth of these materials by solid-state reactions, hydrothermal syntheses and electrochemical deposition under morphological and compositional control to obtain ternary chalcogenide compounds with different physical properties. Moreover, this study reviews the state of the art of the literature on the knowledge about the pseudoternary system, and it sets up perspectives for photovoltaic applications.