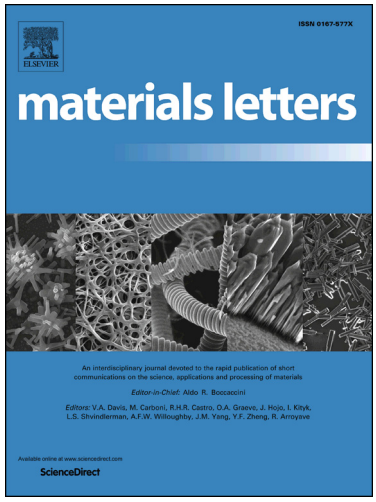

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Secondary phases in Cu_2ZnSnS_4 films obtained by spray pyrolysis at different substrate temperatures and Cu contents

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Abstract. Cu_2ZnSnS_4 (CZTS) thin films prepared by the spray pyrolysis method were studied. This deposition method does not require sophisticated technological setup and allows to easily varying different technological parameters, which is perspective in terms of mass application. Here we show how the variation of the substrate temperature and of the Cu/Zn stoichiometry ratio in the precursor solutions influence the optical and structural properties of CZTS film. The Raman spectra reveal that an increase in the substrate temperature and Cu content leads to a higher disorder of the crystal structure and to the secondary phase formation, in particular, $Cu_{2-x}S$. In turn, the formation of secondary phases significantly affected the CZTS bandgap. We have found that the films with the substrate temperature 289ºC and the Cu/Zn stoichiometric ratio equal to 2.0 comprise a minimum content of secondary phases and having the best crystal structure.