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The Effect of Chlorine on the Morphology and Crystal Structure of Tin-doped Mixed Halide Perovskites

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In this work, we use Rutherford Backscattering Spectrometry (RBS) to investigate the effect of chlorine (Cl) content on the morphology and the crystal structure of tin-doped mixed halide perovskite films. A chemical vapor deposition (CVD) system was used to grow lead-tin (Pb-Sn) halide films using lead chloride (PbCl₂) and tin chloride (SnCl₂) precursor materials. These films were subsequently exposed to CH₃NH₃I (MAI) vapor to form MAPb_{1-x}Sn_xI_{3-y}Cl_y for $0 < x \leq 0.5$. The quantitative analysis and the depth profile of Sn-doped perovskite films show no evidence of a backscattered peak from chlorine anions (Cl⁻) which was expected at about 1920 keV. However, its effect is observed in the morphology and crystal structure of the films. The absence of the Cl peak in the RBS spectra of perovskite films is attributed to a complete replacement of Cl⁻ by the iodine anions (I⁻) during the conversion process. This affirms the high quality of CVD-grown perovskite films over their spin-coated counterparts, which usually depict a Cl peak as a manifestation of an incomplete conversion process.

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