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# Evolution studies on structural and optical properties of CH3NH3PbI3 films prepared by a sequentially sprayed chemical deposition technique

We have successfully prepared layers of CH3NH3PbI3 perovskite on fluorine doped tin oxide (FTO) coated on glass substrates using a sequentially spray-nebulous chemical deposition method. A sequence of spraying Pb(NO3)2 and CH3NH3I aerosols dissolved in non-toxic solvents was carried out to prepare compact and high crystalline CH3NH3PbI3 perovskite films. The concentration of Pb(NO3)2 precursor solution was varied in a range of 0.1 M - 0.3 M while the CH3NH3I concentration was kept constant at 0.2 M. The evolution of crystal structure along with their changes in grain sizes and surface morphologies were investigated by X-ray diffraction (XRD) and scanning electron microscopy (SEM) techniques. The XRD results indicated that sprayed CH3NH3PbI3 films from the Pb(NO3)2 precursor solution with a relatively high concentration i.e. 0.3 M, showed significantly improved crystallinity on the CH3NH3PbI3 perovskite film. The lattice parameters for the tetragonal unit cell are a = 8.845 ± 0.005 Å and c=12.602 ± 0.005 Å. SEM images revealed the morphology of Pb(NO3)2 layer was spongy-like features. These features were converted into a cuboid structure when the aerosols of CH3NH3I were brought into the contact with the Pb(NO3)2 layer, simultaneously the perovskite structure being formed. In contrast to the traditional one-step spin coating approach by which an absorption edge energy of about 1.5 eV was found after evaporating the common solvent, the evolution of the absorption edge energies of CH3NH3PbI3 films as prepared by the sequentially spray-nebulous chemical deposition has gone through an intermediate phase and was found to depend a large extent on reaction time of Pb(NO3)2 and CH3NH3I.

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