Lead halide perovskite films synthesized by rf sputtering

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Currently, there has been a lot of effort in developing low-cost solar cells using semiconductors made with simple processes, in contrast to silicon, an expensive semiconductor, but used largely today in solar panels. Methylammonium lead halide perovskite, mainly the $CH_3NH_3PbI_3$ structure demonstrate incredible performance with efficiency exceeding 23%. The deposition of the perovskite films is usually carried out by solution-based processes using spin coating techniques or through thermal evaporation. In this work new methods are proposed using alternatives routes: 1) from sputtered lead sulphide thin film, 2) lead sulphide (PbS) quantum dots and 3) sputtered lead iodide (PbI_2), all used as precursors for the synthesis of $CH_3NH_3PbI_3$. In the first method, we deposited thin films of lead sulphide and converted them into perovskite by placing the films in an iodine atmosphere, followed by dipping in a solution of methylammonium iodide (CH_3NH_3I). In the second method, PbS thin films were prepared by spin coating PbS quantum dot solution. The conversion of the films in perovskite followed the same steps as above. The first step converts completely the PbS quantum dot thin film into PbI_2 nanowires. The later step converts the PbI_2 nanowires in perovskite nanorods. In the third method we deposited PbI_2 thin films by sputtering a PbI_2 target, and converted them in perovskite by dipping it in a solution of methylammonium iodide. The conversions were confirmed and analyzed by X-ray diffraction, UV-VIS, infrared and Raman spectroscopy, elemental analyses, absorption, and scanning electron microscopy (SEM).

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