CAESIUM LEAD BROMIDE DEPOSITION VIA RF-MAGNETRON SPUTTERING: A NOVEL APPROACH TO INORGANIC PEROVSKITES THIN FILMS

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INTRODUCTION

In the last decade, halide perovskites have attracted the attention of the scientific community thanks to their excellent optoelectronic properties suitable for the realization of novel solar cells, light-emitters and sensors. The main drawback of these materials comes from the significant instability under exposure to atmospheric humidity, high temperatures and light. To overcome this issue inorganic perovskites, with the organic cation substituted by an inorganic one, have been proposed. In this communication, we report on the deposited thin films of $CsPbBr_3$ via one-step magnetron sputtering.

MATERIAL AND METHODS

The deposition was made in a single step, on a glass substrate using a Korvus, HEX magnetron sputtering system equipped with a RF source working at 13.56 MHz. A homemade target was obtained by mixing the two precursors salts (CsBr and $PbBr_2$) in equal molar ratio and pressing the powder to form a 5 cm diameter disk.The deposition was performed at room temperature setting the RF source at 20 W using an argon gas flow of 20 cm^3min^{-1} achieving a dynamic pressure of 0.2 Pa.

RESULTS AND DISCUSSION

The obtained films appeared to be transparent, uniform and lightly orange in color showing a green fluorescence under a 254 nm UV lamp illumination. Semi-quantitative XPS measurements show the film slightly bromine depleted respect to the theoretical value while, the direct band-gap value estimated from DRS measurements, is 2.13 eV, slightly smaller than in the bulk $CsPbBr_3$ (2.4 eV). PL measurements show a decay time slightly faster (≈30 ±50 ps) respect to values reported for spin-coated films and XRD measurements indicate the presence of highly textured $CsPbBr_3$ phase. However, the overall optoelectronic properties behavior turns out to be comparable to state of the art spin coated thin films. In conclusion, here we report the successful deposition of thin, uniform $CsPbBr_3$ films by RF-magnetron sputtering. The optical properties of the deposit are similar to bulk materials. This approach constitute a new route suitable for the realization of large size devices or the implementation of multi-layer heterostructures, opening new scenarios in the current research on perovskite-related functional materials.