Iranian Journal of Physics Research, Vol. 22, No. 1, 2022
DOI: 10.47176/ijpr.22.1.41229

Confining halide perovskite crystals $CH_3NH_3PbBr_3$ in porous aluminum oxide thin film

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(Received 1 April 2021 ; in final form 7 July 2021)

Abstract

In this work, the photoluminescence emission properties of $CH_3NH_3PbBr_3$ perovskite crystals which encapsulated among the porous thin films of aluminum oxide are studied. These porous layers are made by electrochemical anodizing method. First, aluminum thin film has been deposited by magnetron sputtering deposition method and then by changing anodic voltage, different patterns of porous aluminum oxide films are fabricated. Finally, $CH_3NH_3PbBr_3$ nanocrystals are synthesized on the Al_2O_3 porous thin film by one step spin coating method. Morphological studies of porousaluminum oxide thin films are investigated by field emission scanning electron microscopy images and Atomic Force Microscope results. In order to study optical response of $CH_3NH_3PbBr_3$ erovskite pto structural characteristics of porousthin films, photoluminescence spectroscopy has been employed too. By structural characterization, it is found that the number and the average diameter of the nano-pores are increased by anodic voltage raising. Also, the dependence of the emission properties of the encapsulated crystals on the size of the pores has been determined by the photoluminescence spectroscopy. So that, blue-shifted photoluminescence emission has been observed by the pores diameter reduction. Eventually, by comparing the results of structural and optical characterizations with Bruce model, the fabrication of $CH_3NH_3PbBr_3$ perovskite nanocrystals within the patterned aluminum oxide mold is confirmed.

Keywords: confinement, perovskite, photoluminescence, anodize, porous

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