Effect of barium doping on the behavior of conductivity and impedance of organic-inorganic perovskite films

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Abstract: This research focuses on the comparative analysis of effect of barium doping on the behavior of conductivity and impedance of organic-inorganic perovskite films, with an emphasis on their potential application in photovoltaic technology. The structural and electrical characteristics of $CH_3NH_3PbI_3$ thin films with and without Ba are examined. Atomic force microscopy, scanning electron microscopy, energy-dispersive X-ray spectroscopy, and electron backscatter diffraction are used to investigate the morphology and structure of the samples. It was found that light-dependent transport in $CH_3NH_3PbI_3$ thin

films in the temperature range of 77–295 K leads to a tenfold decrease in the activation energy; this decreases from 160 – 280 meV to 10–20 meV as the temperature drops from 300 to 77 K. Light induces an increase in the activation energy at low temperatures, rising from 10 meV in darkness to 15–20 meV in light. $CH_3NH_3PbI_3$ thin films doped with Ba stand out due to their notably higher photoluminescence intensity, suggesting an enhanced crystalline quality and a reduced defect density. Such characteristics are crucial for optimizing the efficiency of solar cells.

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