

Ammonia Sensing Properties of Nanostructured Hybrid Halide Perovskite Thin Film

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Abstract : Hybrid perovskite is new class of material which has gained much attention due to their different crystal structure and interesting optical and electrical properties. Easy fabrication, high absorption coefficient, and photoluminescence properties make them a strong candidate for various applications such as sensors, photovoltaics, photodetectors, etc. In perovskites, ions arrange themselves in a special type of crystal structure with chemical formula ABX_3 , where A is organic species like $CH_3NH_3^+$, B is metal ion (e.g., Pb, Sn, etc.) and X is halide (Cl-, Br-, I-). In crystal structure, A is present at corner position, B at center of the crystal lattice and halide ions at the face centers. High stability and sensitivity of nanostructured perovskite make them suitable for chemical sensors. Researchers have studied sensing properties of perovskites for number of analytes such as 2,4,6-trinitrophenol, ethanol and other hazardous chemical compounds. Ammonia being highly toxic agent makes it a reason of concern for the environment. Thus the detection of ammonia is extremely important. Our present investigation deals with organic inorganic hybrid perovskite based ammonia sensor. Various methods like sol-gel, solid state synthesis, thermal vapor deposition etc can be used to synthesize Different hybrid perovskites. In the present work, a novel hybrid perovskite has been synthesized by a single step method. Ethylenediammedihalide and lead halide were used as precursor. Formation of hybrid perovskite was confirmed by FT-IR and XRD. Morphological characterization of the synthesized material was performed using scanning electron microscopy (SEM). SEM analysis revealed the formation of one dimensional nanowire perovskite with mean diameter of 200 nm. Measurements for sensing properties of halide perovskite for ammonia vapor were carried out. Perovskite thin films showed a color change from yellow to orange on exposure of ammonia vapor. Electro-optical measurements show that sensor based on lead halide perovskite has high sensitivity towards ammonia with effective selectivity and reversibility. Sensor exhibited rapid response time of less than 20 seconds.

Keywords : hybrid perovskite, ammonia, sensor, nanostructure, thin film

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