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Enhanced Energy Powers via Composites of Piezoelectric $CH_3NH_3PbI_3$ and Flexoelectric Zn-Al:Layered Double Hydroxides (LDH) Nanosheets

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Abstract : Layered double hydroxides (LDHs) with positively charged brucite-like layers and negatively charged interlayer anions are considered a critical nanoscale building block with potential for application in catalysts, biological sensors, and optical, electrical, and magnetic devices. LDHs also have a great potential as an energy conversion device, a key component in common modern electronics. Although LDHs are theoretically predicted to be centrosymmetric, we report here the first observations of the flexoelectric nature of LDHs and demonstrate their potential as an effective energy conversion material. We clearly show a linear energy conversion relationship between the output powers and curvature radius via bending with both the LDH nanosheets and thin films, revealing a direct evidence for flexoelectric effects. These findings potentially open up avenues to incorporate a flexoelectric coupling phenomenon into centrosymmetric materials such as LDHs and to harvest high-power energy using LDH nanosheets. In the present study, for enhancement of the output power, Zn-Al:LDH nanosheets were composited with piezoelectric CH3NH3PbI3 (MAPbI3) dye films and their enhanced energy harvesting was demonstrated in detail.

Keywords : layered double hydroxides, flexoelectric, piezoelectric, energy harvesting
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