



Scanning Probe Studies of the Piezoelectric and Ferroelectric Properties of Organic Trihalide Perovskites for Photovoltaic Applications

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Abstract

Layer perovskite based solar cells, specifically CH_{3NH₃PbI₃}, have shown promising photovoltaic efficiency due to their high carrier mobility and long photo-generated length. It has been demonstrated that the piezoelectricity of perovskites is enhanced by the presence of a ferroelectricity. In this work, we have grown a MAPbI₃ on a ferroelectric substrate, BiFeO₃, and we have performed scanning probe microscopy (SPM) and scanning probe piezoelectric microscopy (SPPM) to study the piezoelectric and ferroelectric properties of the layered structure. We find that the piezoelectricity of the MAPbI₃ is enhanced by the presence of the ferroelectricity. The piezoelectricity is enhanced by a factor of 100 and the carrier mobility is enhanced by a factor of 1000. The piezoelectricity is enhanced by a factor of 1000. The piezoelectricity is enhanced by a factor of 1000.

Motivation

MAPbI₃ is showing promising alternative to photovoltaic applications. It has been proposed that the high photovoltaic response is due to the presence of ferroelectric domains. Piezoelectric measurements of ferroelectricity have not been reported.

Experimental Setup

Ferroelectric Properties of Bare PZT

Ferroelectric Domain Writing

Piezoresponse and Hysteresis Loop

Ferroelectric Properties of MAPbI₃ on BiFeO₃

Piezoelectricity Measurement

Characterization of MAPbI₃/PZT system in the piezoelectric mode.

