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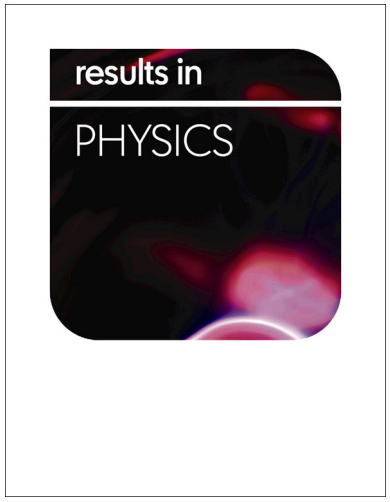

Interfacial energy band bending and carrier trapping at the vacuum-deposited $MAPbI_3$ perovskite / gate dielectric interface

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PII: S2211-3797(18)31304-4
DOI: https://doi.org/10.1016/j.rinp.2018.08.043
Reference: RINP 1633

To appear in: *Results in Physics*

Received Date: 2 June 2018
Revised Date: 18 August 2018
Accepted Date: 22 August 2018

Please cite this article as: Park, Y., Park, B., Interfacial energy band bending and carrier trapping at the vacuum-deposited $MAPbI_3$ perovskite / gate dielectric interface, *Results in Physics* (2018), doi: https://doi.org/10.1016/j.rinp.2018.08.043

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Interfacial energy band bending and carrier trapping at the vacuum-deposited $MAPbI_3$ perovskite / gate dielectric interface

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Abstract

We report energy band bending of methylammonium lead halide ($MAPbI_3$) perovskite film in contact with indium-tin-oxide (ITO) surface using photoelectron spectroscopy in air (PESA) and ultraviolet photoelectron spectroscopy (UPS) measurements. $MAPbI_3$ perovskite films were vacuum-deposited using co-evaporation of methylammonium iodide (CH_3NH_3I, MAI) and lead iodide (PbI_2) powders. Using PESA and UPS, the highest occupied molecular orbital levels were measured varying the thickness of the perovskite films. Substantial energy band bending close to the ITO surface was not observed. The vacuum-deposited perovskite films feature ambipolar carrier transport from field effect current measurements. Particularly, the threshold voltage for electron conduction was -20 and 25 V for the forward and reverse gate scans, exhibiting significant current hysteresis. The magnitude of the threshold voltage, far away from zero gate voltage, implies that interface trapping rather than energy band bending dominate the threshold voltage. In other words, perovskite/gate dielectric interface trap states for electrons modulate the magnitude of the threshold voltage. Our work provides insights into the origin of gate voltage dependent threshold voltage in perovskite FETs minimizing the

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