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Electronic Structure Evolution of Fullerene on CH3NH3PbI3[1]
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— The thickness dependence of fullerene on $CH_3NH_3PbI_3$ perovskite film surface has been investigated by using ultraviolet photoemission spectroscopy (UPS), X-ray photoemission spectroscopy (XPS) and inverse photoemission spectroscopy (IPES). The lowest unoccupied molecular orbital (LUMO) and highest occupied molecular orbital (HOMO) can be observed directly with IPES and UPS. It is observed that the HOMO level in fullerene shifts to lower binding energy. The XPS results show an initial shift of core levels to lower binding energy in the perovskite, which indicates that electrons transfer from the perovskite film to fullerene molecules. We observed that the WF of the perovskite is 5.0 eV and the VBM is 0.6 eV. The band gap of the perovskite is 1.66 eV, which is in accordance with previous reports. We also observed the HOMO level of C_{60} shifts to lower binding energy, indicating a band bending in the C_{60} region. The perovskite core levels show a strong initial shift to lower binding energy, indicating electron transfer from the perovskite film to fullerene molecules. The strongest electron transfer happened at 1/4 monolayer of fullerene, and further deposition reduced the transfer as forms fullerene forms C_{60} solid film.

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