Revealing the Dynamics of Thermal Reaction Between Cu and Mixed Halide Perovskite Solar Cells

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Copper (Cu) has been used not only for electrode for inverted structured perovskite solar cells (PSCs), but also as transporting layers such as copper iodide (CuI), copper thiocyanate (CuSCN) and copper phthalocyanine (CuPc) alternative to Spiro-OMeTAD due to their improved thermal stability. Many works have widely focused on the Cu-induced improvements in the device performance [1,2]. However, there is a lack in the thorough investigation on direct reaction between Cu and perovskite by thermal deposition of a thin layer of Cu (1 and 3 nm) on perovskite layer. In this study, we investigated the thermal reaction between Cu and perovskite and degradation mechanism by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and Kelvin probe force microscopy (KPFM). The results show that high temperature at 100 °C induces Cu to be incorporated into the perovskite lattice by forming 'Cu-rich yet A-site poor' perovskites, $(Cu_xA_{1-x})PbX_3$, near the grain boundaries, which results in poor final device performance.

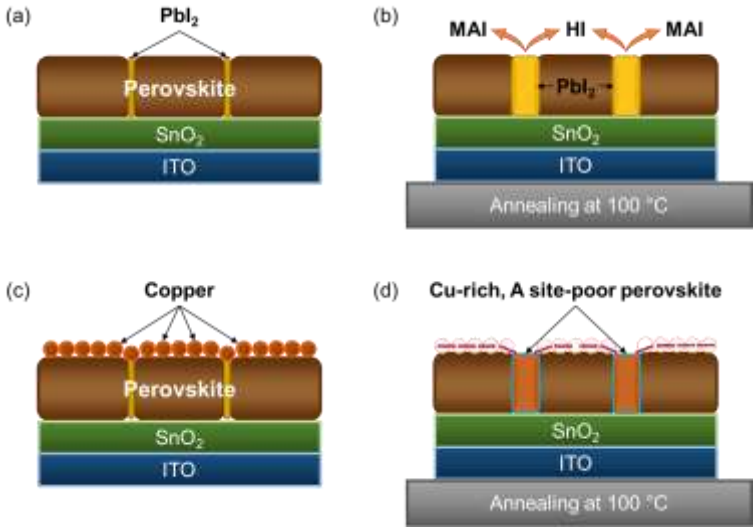

Figure 1. Schematic illustration of thermal reaction of copper with perovskite layer before and after annealing.

References

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