Sub area: Perovskite photovoltaics and related technologies.

Top-contacts-interface Engineering for High-performance Perovskite Solar Cell with Reducing Lead Leakage

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Though great achievements have been realized in perovskite solar cells (PSCs), there are still some thorny challenges that exist such as 1) How to minimize the interfacial nonradiative recombination losses; 2) How to balance the power conversion efficiency (PCE) and environmental friendliness of the PSCs[1-4]. Here, effective top-contacts-interface engineering is developed via using a new multi-active site Lewis base molecule named emtricitabine (FTC)[5]. Both experimental and theoretical results confirm that a strong chemical interaction exists between FTC and Pb^{2+}. After FTC treatment, the perovskite thin film has fewer defects density than the control film, meanwhile, the interfacial hole extraction becomes better due to the more matched energy level. Upon the FTC passivation, the PCE of the PSCs is improved from 20.83% to 22.24%. Simultaneously, the humidity stability of the PSCs is improved after the FTC modification. Last but not least, the unpackaged target film showed less lead leakage than the control film.

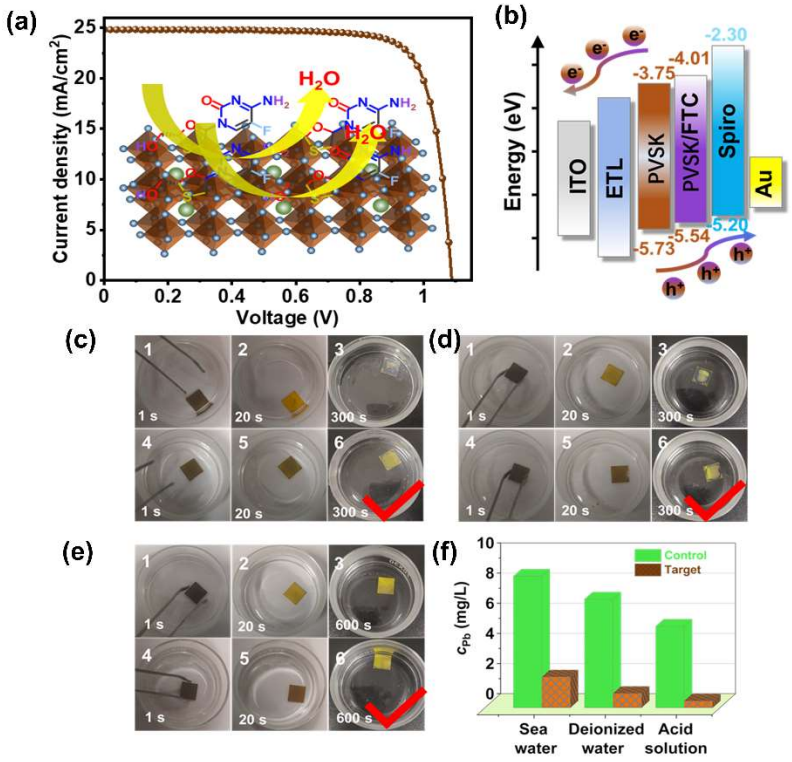

Figure 1: (a) J-V curve of the perovskite solar cell-based FTC modified. (b) Energy level diagram of device components in this work. The pictures of (c) seawater, (d)deionized water, and (e) acid solution test on both the pristine perovskite and FTC treated films. Note that the pH value of deionized water was adjusted to about 5.6 to simulate acidic rain conditions. (f) The Pb concentration under different conditions was measured by ICP-MS. Photo credit: Huan Bi, The University of Electro-Communication.

References

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