Highly efficient and stable metal halide hybrid perovskite solar cells

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The defects existing in light-harvesting perovskite layers strongly limit power conversion efficiencies (PCEs) and long-term stability of lead halide perovskite solar cells (PSCs). While organic ammonium halides have been used for defect passivation for high-performance PSCs, increasing the operational stability is still challenging. Herein, we developed a novel material of pyridine-carbazole (Py-Cz) to passivate the defects via a coordination bonding. Three different sets of PSCs were constructed with the device architecture shown in the inset of Fig. 1a, namely, without passivation, with commonly used phenethylammonium iodide (PEAI) passivation), and with Py-Cz passivation. Remarkably, the PSCs fabricated using Py-Cz passivation not only achieved PCEs of over 20% (Fig. 1a) but they were also able to retain 95% of their initial performance under more than 2,500 h of solar illumination (Fig. 1b). In contrast, the PSCs without or with PEAI passivation degraded quickly during the long-term operational stability test under light illumination. This method opens up a new opportunity to develop high-efficiency and operationally stable PSCs.

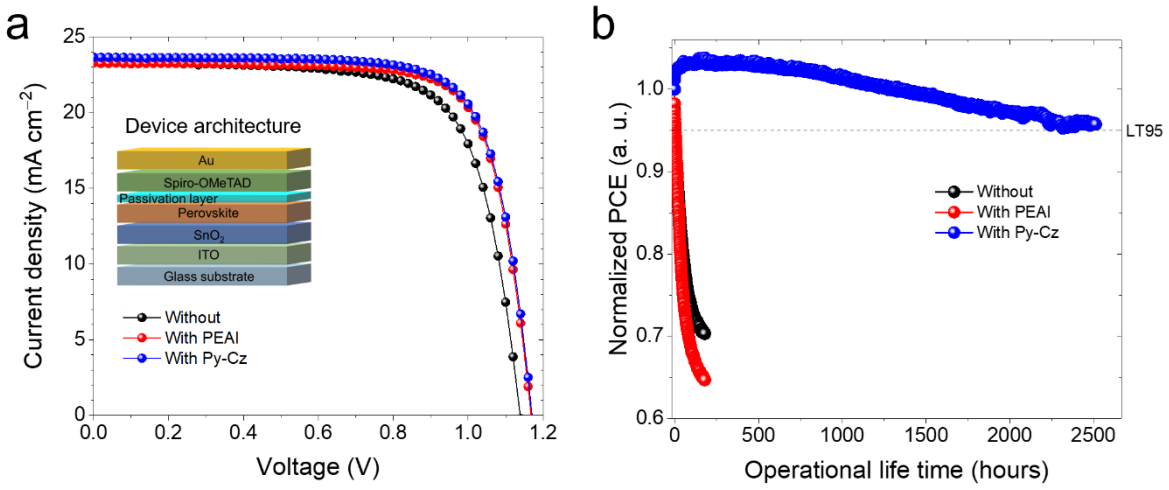

Figure 1. a) Current density-voltage curves and b) operational stability of PSCs