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Efficient and stable metal halide hybrid perovskite solar cells

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We show that the introduction of benzoquinone (BQ) into a metal halide hybrid perovskite film greatly enhances both power conversion efficiency and stability of solar cells. The morphology and crystal quality of the hybrid perovskite films were improved because intermolecular interaction between methylammonium iodide and BQ slowed the rate of perovskite crystal formation. Further, electron transfer from hybrid perovskite to BQ reduces charge recombination losses, and the oxidizing ability of BQ effectively suppresses the formation of metallic lead, a source of carrier traps, under continuous solar irradiation. Through BQ addition, the conversion efficiency was enhanced from 10.7% to 15.6% and lifetime extended about twenty-six times.

More recently we systematically optimized perovskite film fabrication conditions and solar cell architectures. We achieved very high photon-to-electron conversion efficiencies of up to 21.5% and half lifetimes of up to 23,000 h. These values are already higher than the 2020 milestone values in the I2CNER project roadmap.

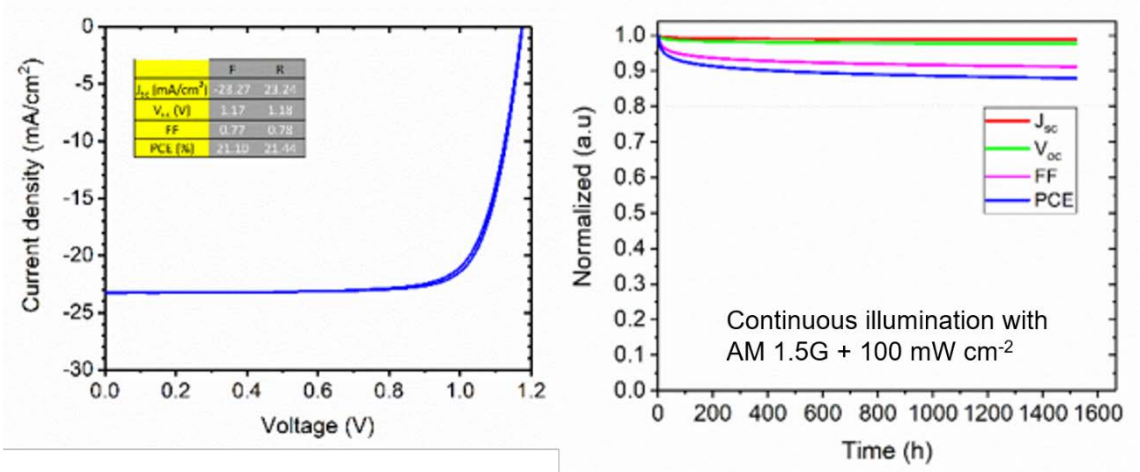

Figure. Our latest results of hybrid perovskite solar cells.