

Memristive perovskite solar cells for self-powered IoT edge computing

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Abstract:

Mixed halide perovskites (HP) have been used as active layer in highly performing solar cells (PSC) that had led to efficient solar energy harvesting. Moreover, HP's rich dynamics enabled by the inherently coupled ionic and electronic degrees of freedom have also led to optoelectronic memristors emulating synaptic- and neural-like dynamics. A single printable material stack fabricated with low manufacturing cost at low temperature, combining both efficient solar energy harvesting and memristive functionalities would constitute a transformational breakthrough.

In our work we demonstrate an inverted PSC with an average power conversion efficiency (PCE) of ~17% (champion 17.97%) that upon appropriate electric bias procedure exhibits stable resistance switching characteristics without losing its PCE performance even after thousands of switching cycles (this device is termed as MemPVcell). MemPVcell demonstrates a light-tuneable High Resistance State (HRS) to Low Resistance State (LRS) ratio of up to 10^5 , fast switching cycles (in ms regime) with endurance of 3×10^3 cycles with no detectable HRS/LRS ratio drop. Corresponding PCE performance was monitored after multiple resistance switching loops and endurance cycles exhibiting a full PCE recovery to its initial value within few minutes of rest.