Novel Perovskite-based Photo-rechargeable Supercapacitor

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Supercapacitors that integrate energy harvesting and energy storage technologies have attracted so much attention over the last decade due to their importance in applications that require rapid charge/discharge cycles. There is a very elevated need of less complex devices than the extrinsic combination of an energy harvesting and energy storage components. Therefore, this work aims for the first time to use CuI3SbI6 perovskite material in integrating an energy harvester with an energy storage capability into one device. The goal is to decrease the overall footprint, ohmic transport losses and eliminate the need for additional external electronics to match the output of the solar cell to the energy storage device. A novel antimony-based perovskite halide gel, APH gel, has been made to be used as an electrolyte and a CuI3SbI6 has been made to be used on the electrodes for the exact purpose of developing an EDLC/Pseudocapacitance supercapacitor. It was then tested by multiple characterization instruments. A capacitance enhancement of 462.4% was recorded for the CuH photo-responsive EC, under illuminated condition, at a scan rate of 0.01 V/s. Maximum energy density and power density of 9.98 Wh/cm2, and 3.18 mW/cm2 were attained under illumination, respectively. This emphasizes that perovskite may be a beneficial material that could be utilized in so many potential applications such as, security gadgets, IoT devices, photodetectors, X-ray imaging and solar cells.

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