21 Century Disruptive Photovoltaics: Perovskite Solar Cell

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Since the first report on the solid-state perovskite solar cell with power conversion efficiency (PCE) of 9.7% in 2012 by our group, the certified PCE now reaches 22%. It is believed that perovskite solar cell is promising next-generation photovoltaics (PVs) due to superb performance and low cost. In this talk, the history of perovskite photovoltaics will be briefly presented along with scientific progress of perovskite solar cells. Methodologies to achieve hysteresis-free, stable and high PCE perovskite solar cells will be introduced. Lewis acid-base adduct approach has been found to be very reliable and reproducible method to get high quality perovskite layer minimizing non-radiative recombination. Non-stoichiometric precursor in adduct process demonstrated grain boundary healing effect, which further improved voltage and fill factor due to long carrier life time of perovskite and improved charge transporting at grain boundary as well. Grain boundary healing process yields PCE as high as 20.4%. Moisture was effectively protected and hysteresis was significantly reduced by introducing 2-dimensioanl perovskite at grain boundary of 3-dimensional perovskite. Thermal stability of perovskite material was found to be stable up to 120 ^{o}C in the absence of moisture, but that of full device was sensitive to selective contacts, indicating that thermally stable selective contacts are equally important. Universal method to remove hysteresis will be also given in this talk. Beyond PV, recent progress in resistive memory, light emitting diode and photodetector based on halide perovskite will be also covered in this talk.

References

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