Improving the Performance of Perovskite Solar Cells Using a Polyphosphazene Interlayer

Bekele Hailegnaw(bekele.teklemariam@jku.at)[1], Vanessa Poscher[2], Christoph Ulbricht[1]
Hathaichanok Seelajaroen[1], Ian Teasdale[2], Yolanda Salinas[2]
Niyazi Serdar Sariciftci[1], Markus Clark Scharber[1]
[1]Linz Institute for Organic Solar Cells (LIOS), Institute of Physical Chemistry, Johannes Kepler University Linz, [2] Institute of Polymer Chemistry (ICP) and Linz Institute of Technology (LIT), Johannes Kepler University Linz

Abstract

The choice of charge-carrier selective materials and interfaces have shown to have a crucial role on the performance and stability of hybrid organic-inorganic lead halide perovskite based solar cells. In this contribution, we will present our work on the impact of thin layer of inorganic/organic molecular hybrid, polyphosphazene derivatives, as a buffer layer between the electron transporting layer and back metal-contact in mixed-cation mixed-halide perovskite solar cells. Similar improvement was achieved for mixed halide perovskite solar cells. PSCs with the interlayer exhibit enhanced rectification in the photoinduced current-voltage (J-V) curves, show improved photovoltaic performance and photostability with reduced hysteresis. The thickness of the interlayer was optimized and the optimized PSCs with PPz buffer layer showed an average open-circuit voltage (VOC) of approximately 1.05 V, a short circuit current density (JSC) of around 23.5 mA/cm2, a fill factor of ca.72 %, and a power conversion efficiency of about 17.3 % for the forward and reverse scans under simulated AM1.5G illumination. Moreover, the application of PPz as an electron transporting interlayer in organic solar cells reveals that PPz interfacial layer improves the electron extraction at the cathode. The merit of applying PPz interlayer extends to the possibility of using different metals (such as aluminum, gold, copper and silver) as top contact in the prepared PCSs. In general, this investigation discloses a very promising approach to tackle the issue of interfacing, and to improve the performance and stability of PSCs.

Biography

PhD Candidate at Linz Institute for Organic Solar Cells (LIOS)/ Institute of Physical Chemistry, Johannes Kepler University Linz, Austria
M.Sc. in Chemical Science (Materials and interface Sciences) from Weizmann Institute of Science, Israel
M.Sc. in Chemistry (Physical Chemistry) from Addis Ababa University, Ethiopia
Bachelor Degree in Chemistry from Bahir Dar University, Ethiopia