Modified TiO_2 Interface for High-performance Perovskite Solar Cell

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In the past years, perovskite solar cell has abstracted much concentration as its excellent photovoltaic properties. Although the development is fast and the photoelectric conversion efficiency (PCE) has been quickly over 21%, the carrier's collection and transport is still need to be improved because of the insufficient electrical interface contact. Normally, for the high performance device, during the transporting process, carriers need to go across the perovskite/hole transporting layer (HTL) and perovskite/electron transport layer (ETL) interfaces, the electronic transporting layer are TiO_2[1], ZnO[2], NiO[3] and other inorganic materials, its electrical contact with the organic perovskite system is still to be improved. Superior interface contact can result in full efficient charge extraction and collection, this is a main issue for the further development. Therefore, many workers from all over the world are devoting themselves to interface engineering.

For this purpose, the silane coupling agent is popular to modify the interface between inorganic and organic layer, since it possesses both inorganic and organic terminals, and the siloxy group is easy to make reaction with inorganic substances[4]. In this work, we inserted a kind of silane coupling agent (SCA) between TiO_2 and perovskite layer, and further modify its terminal with halogen elements to form more tension interface, expecting it to coordinate with perovskite crystals. By details analysis, there is a clear improvement in perovskite crystallization and conductive properties, and interfacial trap sites. The result show that this modification can improve the fill factor (FF), short circuit current density (J_{SC}), and hence higher PCE, as shown in Fig. 1.

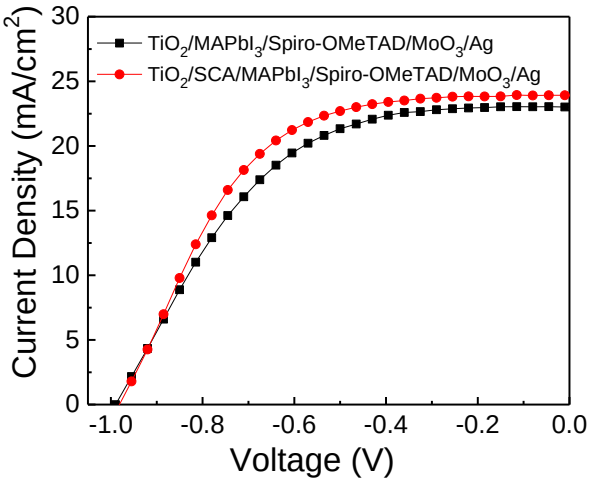

Fig. 1. Photovoltaic performance of device with and without modified TiO_2 interface based device.

References

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