The crucial role of blocking layers in perovskite solar cells with the carbon back electrode

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Hybrid perovskite solar cells (PSC) are considered as one of the most promising generation of photovoltaic devices due to their low cost of preparation, high power conversion efficiency, ecological and simple production by the coating and printing techniques.

The aim of this work is focused on the preparation and optimization of blocking layers based on TiO_2, SnO_2 and ZnO nano-oxides, their application in mesoporous perovskite solar cells with the carbon back electrode (cPSC), prepared by spin-coating and screen-printing techniques. Blocking layers have several crucial functions such as charge (electron) transfer from perovskite to transparent conductive oxide electrode (TCO) and prevent to direct contact between perovskite and TCO. Therefore it is important to optimize these layers. Our cPSC use different oxide blocking layers, mesoporous TiO_2 layer, porous ZrO_2 scaffold space and separating layer, carbon back electrode through which were the perovskite precursors infiltrated.

The individual functional layers of solution processed cPSC have been characterized by optical and atomic force microscopy, electrical conductivity measurement and the conversion efficiency was determined measuring photocurrent-voltage load characteristics under 1000 W/m^2 of standard day light exposition. The prepared blocking layers were homogenous and compact without any cracks and visible defects.

The best results (power conversion efficiency of cPSC 7,8 %) have been achieved with the structure which includes blocking layers based on TiO_2 prepared by sol-gel process combining precursors TiAcAc and $TiCl_4$.