Aluminum as an anode for heterojunction perovskite solar cells assisted by hole extraction layers

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Perovskite solar cells (PSCs) are showing great progress in thin-film solar cell technology. High carrier mobility, broad absorption range, and long range exciton diffusion length, these characteristics made perovskite (methyl ammonium lead halide) film to be an excellent candidate for light-harvester and lead to high photovoltaic performance. The inverted device structures have advantages in high electron-hole balance. To make this high charge carrier balance, gold is mostly used because it is well matched with hole transport materials (HTMs) such as Spiro-MeoTAD, P3HT, PTAA, PCDTBT, etc. Although gold has good performance as an anode, using gold leads to high fabrication cost.

In this work, we tried various materials which can be substituted for gold anode in inverted PSCs. Instead of Au, we stacked molybdenum(VI) oxide (MoO_3), tungsten(VI) oxide (WO_3), dipyrazino[2,3-f:2',3'–h]quinoxaline-2,3,6,7,10,11-hexacarbonitrile (HAT-CN) and lithium fluoride as hole injection layer (HIL) which helps hole to migrate easily from Spiro-MeoTAD to aluminum (anode). Then we analyzed current density-voltage characteristics depending on different light intensity of each solar cell. From these analyses, we can have electrical and optical characteristics of each device without using gold anode.

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