

A hole-conductor-free, fully printable mesoscopic perovskite solar cell with high stability

With the support by the National Natural Science Foundation of China (Grant No. 61106056), Prof. Han Hongwei's group at Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, reported a hole-conductor-free, fully printable mesoscopic perovskite solar cell with high stability, which was published in *Science* (2014, 345(6194): 295–298).

Solar power generation is an effective way to solve the problem of energy and environment. For its low cost, the mesoscopic solar cells based on mesoscopic organic or inorganic materials and three-dimensional interpenetrating network structure are being widely studied. Within the past two years, the mesoscopic solar cell was developed quite rapidly with the application of perovskites such as MAPbI₃ and a certified record efficiency of 17.9% was obtained. However, most of these devices use noble metals such as gold as the counter electrode and also adopt organic hole transport materials such as the widely used *spiro*-OMeTAD (the reported price of which is ten times as much as Au or Pt). Thus, how to develop perovskite solar cells with high and stable efficiency under the condition of low cost is still an issue before its application.

Drawing lessons from the development of perovskite solar cells and mesoscopic solar cells, Prof. Han's group developed a mixed-cation perovskite (5-AVA)_x(MA)_{1-x}PbI₃ by introducing 5-aminovaleric acid (5-AVA) cation and applied it in hole-conductor-free, fully printable mesoscopic solar cells based on carbon counter electrodes. The characterization of the device is that the TiO₂ nanocrystalline layer, the ZrO₂ spacer layer and the carbon counter electrode are printed on a single FTO substrate layer by layer, and then perovskite solution is dropped onto the cells and dried. The results indicate that the devices present good stability and repeatability with the new perovskite materials and an efficiency of 12.84% is achieved, which is certificated by an accredited PV laboratory and also is the highest reported value of hole-conductor-free perovskite solar cells in the world.

The fully printable mesoscopic solar cell developed by Prof. Han's group meets the demand of cheap photovoltaic. Reviewers commented that 'breakthrough', 'a remarkable, certified, result that will have a huge impact on future development of photovoltaics'.

For full report: <http://www.sciencemag.org/content/345/6194/295>

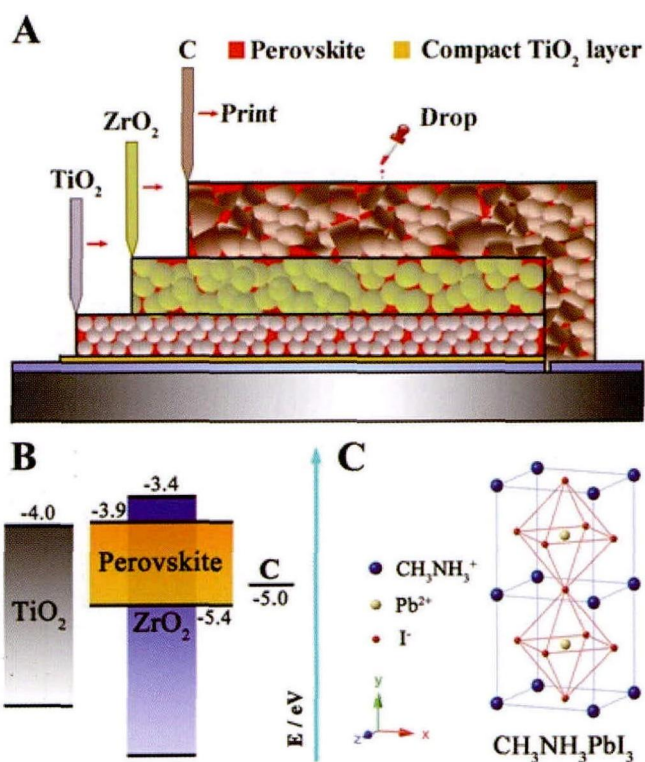


Figure A, Schematic drawing of the fully printable perovskite solar cell. B, Energy band diagram. C, The crystal structure of MAPbI₃ perovskite.