Plasmonic perovskite solar cells based on Ag-embedded TiO_2 nanotube arrays with P3HT as hole transfer materials

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Perovskite solar cells have received much attention due to their high-energy conversion efficiency and low cost in comparison with conventional solid-state solar cells. The energy conversion efficiency of perovskite solar cells is affected by many factors, including the structure of perovskite (methylammonium lead iodide CH3NH3PbI3, MAPbI3), the valence and conduction bands, the large surface area available for perovskite solar cells, and the transport kinetics of the electrons. Metal nanoparticles such as Au or Ag have been used for light harvesting by surface plasmon resonance (SPR) in solar cells and the energy conversion efficiency of perovskite solar cells has been increased by introducing Au NPs into the TiO2 nanoparticle films. However, this method is complicated or difficult to apply to free-standing TiO2 nanotube array. Here, we report the combination of perovskite solar cells with Ag-embedded TiO2 nanotube arrays. We found that the Ag NPs could be introduced on TiO2 nanotube arrays by simple UV irradiation in the presence of a Ag source.