

Rapid Flame-processed Metal Oxide Electron Transport/Selective Layers for Organic-Inorganic Hybrid Solar Cells

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Mesoporous TiO₂ nanoparticle (NP) films are broadly used as electrodes in photoelectrochemical cells, dye-sensitized solar cells (DSSCs), and perovskite solar cells (PSCs). State-of-the-art mesoporous TiO₂ NP films for these solar cells are fabricated by annealing TiO₂ paste-coated fluorine-doped tin oxide glass in a box furnace at 500 °C. Here, the use of a nontraditional reactor, i.e., flame, is reported for the high throughput and ultrafast thermal treatment of TiO₂. Flame has a broad tunable temperature range; therefore, flame has an intrinsic temperature field with a large gradient. Hence, flame treatment, when coupled with FTO glass cooling, could provide the desired temperature field for processing TiO₂ films on FTO. Thus, the flame annealing of TiO₂ paste can be a promising approach for fabricating PSCs with enhanced charge transport performance. In addition, a sol-flame doping process to introduce Co dopant into TiO₂ will be introduced. Ultra-fast flame-processed Co-doping of TiO₂ solves the J-V hysteresis problem and increases the power conversion efficiency of both mesoscopic and planar PSCs.