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TiO2 Nanotubes Fabricated by Atomic Layer Deposition for Solar Cells

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Titanium (IV) dioxide (TiO2) is one of the most attractive d-block transition metal functional oxides. Many applications of TiO2 such as dye-sensitized solar cells and photocatalyst have been widely investigated. To utilize solar energy efficiently, TiO2 should be well-aligned with a high surface area and promote the charge separation as well as electron transport. Herein, the TiO2 nanotubes were successfully fabricated by a template-directed method. The electrospun PEO(Polyethylene oxide, Molecular weight, 400k)fibers were used as a soft template for coating with titanium dioxide using an atomic layer deposition (ALD) technique. The deposition was conducted onto a template at 50°C by using titaniumisopropoxide [Ti(OCH(CH3)2)4; TTIP] as precursors of TiO2. While the as-deposited TiO2 layers onto PEO fibers were completely amorphous with atomic layer deposition, the TiO2 layers after calcination at 500°C for 1 h were properly converted into polycrystalline nanostructured hallow TiO2 nanotube. The TiO2 nanotube with high surface area can be easily handled and reclaimed for use in future applications related to solar cell fabrications.

Keywords: Atomic layer deposition, Electrospinning, TiO2 nanotube, Solar cell