Titanium dioxide thin films prepared by electrolysis from aqueous solution of titanium–lactic acid complex for dye-sensitized solar cells

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Abstract

Titanium oxide (TiO_x) thin films were prepared on transparent conducting substrate (fluorine-doped tin oxide) by cathodic electrolysis of a solution containing a titanium bis(ammonium lactato)dihydroxide and an ammonium nitrate at 323 K. Post-deposition treatment: calcination at 723 K or hot-water treatment at > 363 K promoted the growth of an anatase type crystalline phase in the TiO_2 thin film, as evidenced by X-ray diffraction and X-ray photoelectron spectroscopy. The calcined films were used as electrodes of a dye-sensitized solar cells and the cells' energy conversion efficiency was comparable to that obtained with commercially available TiO_2 nanoparticle electrodes.