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Porous nanocrystalline TiO_2 thin films for dye-sensitized solar cells XIAOJUAN FAN, Marshall University, CLAUDIA SWANSON, DAVID ROGOW, University of California, AKHILESH TRIPATHI, Rigaku Corporation, SCOTT OLIVER, University of California — We report a rapid and low cost method to fabricate porous TiO_2 thin films used as anode electrodes for solid state dye-sensitized solar cells. Polymethylmethacrylate (PMMA) gel was used as template to define a network co-structure with alkali titanium oxide, then spin cast on substrates. After thermally removing polymer, smooth and crack-free large area TiO_2 thin films with fine pores were generated. Thin film structures were detected by powder & grazing incident X-ray diffraction. Film thickness can be controlled over a range of tens of nanometers to several microns by precursor viscosity, spin coating speed and coating times. The SEM image shows the highest quality porous TiO_2 film derived from a certain concentration of precursor. The above TiO_2 thin films were then used to fabricate solid state dye sensitized solar cells. Porphyrine dye and poly(ethylene glycol) electrolyte with I^-/I_3^- redox couple were used in the cells. Current-voltage curves were recorded. The open circuit voltage boosts to more than 1.0 V. The reasons for the high open circuit voltage probably will be discussed. Overall photo-electricity conversion efficiency reaches 2.05% under an illumination of one solar unit (AM1.5, 100 mW/cm^2).

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