

Hydrothermal synthesis, characterization, photocatalytic activity and dye-sensitized solar cell performance of mesoporous anatase TiO₂ nanopowders

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Abstract:

Mesoporous anatase TiO₂ nanopowder was synthesized by hydrothermal method at 130 C for 12 h. The samples were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), selected-area electron diffraction (SAED), HRTEM, and Brunauer-Emmett-Teller (BET) surface area. The as-synthesized sample with narrow pore size distribution had average pore diameter about 3-4 nm. The specific BET surface area of the as-synthesized sample was about 193 m²/g. Mesoporous anatase TiO₂ nanopowders (prepared by this study) showed higher photocatalytic activity than the nanorods TiO₂, nanofibers TiO₂ mesoporous TiO₂, and commercial TiO₂ nanoparticles (P-25, JRC-01, and JRC-03). The solar energy conversion efficiency (η) of the cell using the mesoporous anatase TiO₂ was about 6.30% with the short-circuit current density (J_{sc}) of 13.28 mA/cm², the open-circuit voltage (V_{oc}) of 0.702 V and the fill factor (ff) of 0.676; while η of the cell using P-25 reached 5.82% with J_{sc} of 12.74 mA/cm², V_{oc} of 0.704 V and ff of 0.649. (c) 2007 Elsevier Ltd. All rights reserved.

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