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1. Introduction

Nanostructured TiO₂ materials are believed to be the future material that can ease the energy shortage by its capability in solar power utilization. In recent years, TiO₂ nanostructures including nanotubes (NT), nanorods (NR), and nanowires were prepared by different methods for various applications. In this study, we report the hydrothermal etching method to grow TiO₂ nanotubes on FTO glass. TiO₂ rutile-anatase nanotube core-shell structure was prepared and showed superior photocatalytic property.

2. Results

Figure 1 SEM images of the TiO₂ nanorod arrays grown on FTO glass at 150 °C for 5-41 h. (a) 5 h, (b) 14 h, planar view, (c) 14 h, and (d) 41 h, cross-sectional view.

Figure 2 SEM image of TiO₂ NR arrays after different etching process. (a) complete etching of TiO₂ NTs in 6.67M HCl at 150 °C for 7 h; (b) partially etched TiO₂ NRs in 5M HCl at 150 °C for 7 h; (c) Over-etched TiO₂ NRs(FTO glass exposed) in 6.67 M HCl at 150 °C for 8 h

3. Summary

TiO₂ rutile-anatase core-shell NT arrays were successfully prepared on FTO glass by a three-step growing/etching/coating method. The core-shell NT structure achieved superior decomposition performance because of the larger surface area of the roughened shell structure, existence of anatase phase and the formation of large amount of rutile-anatase surface-phase junctions in the system.

Figure 3 (a) XRD patterns of bare FTO glass, NT, NR and NR grown on APCVD seed layer.

Figure 4 SEM images of (a) TiO₂ core-shell NR arrays after TiCl₄ post-treatment; (b) TiO₂ core-shell NT arrays after TiCl₄ post-treatment; (c) TEM image of a single TiO₂ core-shell NT after post-treatment; (d) HRTEM image of TiO₂ rutile-anatase core-shell NT.

Figure 5 (a) Photodegradation of 30 ppm Methyl Blue under UV light by different substrates (b) Schematic drawing of the photocatalytic degradation mechanism.