20a Synthesis and Application of Ultrahigh Crystalline Titania Nanotubes

M.Alam Khan ,Hynchul Lee and O-Bong Yang Yang Sr.

The driving force for perusing research on single crystalline titanium dioxide nanotube owing to its high photocatalytic ,environmental remediation and wide range of applications with expectations that insight into surface properties on fundamental level which improve materials and device performance in many fields, It is one of the most important oxide semiconductor material which has been extensively studied owing to its superior physical and chemical properties. We prepared titania nanotube, which was only anatase phase, by hydrothermal method and we chemically modify it to augment its crystallinity for its broader application. These Ultrahigh crystalline Titania nanotubes were first synthesized by modified chemical treatment of very low crystalline titania nanotubes which were prepared by hydrothermal method in aqueous alkaline solution. Thus chemically modified ultrahigh crystalline TiO2 nanotube showed surprisingly high crystallinity comparable to well known high crystalline Titania nanoparticles. These modified high crystalline nanotube was found to be a multi-walled anatase phase only with an average outer diameter of (8 nm and inner diameter of (5 nm, and well grown along [001] direction to 500 – 700 nm long with the interlayer fringe distance of ca. 0.78 nm.To examine the photocatalytic activities of as prepared and modified titania nanotubes, photoactalytic oxidation of trimethylamine (N (CH3) 3) gas was carried out under UV (254 nm) irradiation. The slurry of TiNTs was prepared by mixing 2 g of titania nanotubes with 5 ml distilled water, and coated through doctor blade method on both sides of the slide glass plate. The amount of coated nanotubes was controlled and kept ca. 1 g. After the plate dried at room temperature, the plate was installed horizontally in a center of the quartz tubular reactor. The reactor was first flushed by flowing He for 30 min and then reactant mixture (200 ppm TMA, 20% O2 and 80% N2) was introduced into the reactor (100 ml/min). After the gas–solid adsorption achieved equilibrium by flowing through the reactant mixture for 10 min; UV lamps were switched on to start the reaction. The reactant and products were analyzed by the on-lined quadruple mass spectrometer (Balzers QMS200). The photocatalytic activity of modified titania nanotube was about 2-fold higher than that of titania nanotube as prepared in the photocatalytic oxidation of trimethylamine gas under UV irradiation. The detail structure of nanotubes were elucidated by HR-TEM, FE-SEM, TEM-EDX, XRD, Photoluminescence and BET surface area.