

Fabrication of highly ordered TiO₂ Nanotubes from Fluoride containing Aqueous Electrolyte by Anodic Oxidation and their Photoelectrochemical response.

ABSTRACT

The fabrication of TiO₂ nanotubes (TNT) was carried out by electrochemical anodization of Ti in aqueous electrolyte containing NH₄F. The effect of electrolyte pH, applied voltage, fluoride concentration and anodization duration on the formation of TNT was investigated. It was observed that self-organized TNT can be formed by adjusting the electrolyte to pH 2-4 whereby applied voltage of 10-20 V can be performed to produce highly ordered, well-organized TNT. At 20 V, TNT can be fabricated in the concentration range of 0.07 M to 0.20 M NH₄F. Higher fluoride concentration leads to etching of Ti surface and reveals the Ti grain boundaries. The prepared TNT films also show an increase in depth and in size with time and the growth of TNT films reach a steady state after 120 minutes. The morphology and geometrical aspect of the TNT would be an important factor influencing the photoelectrochemical response, with higher photocurrent response is generally associated with thicker layer of TNT. Consequently, one can tailor the resulting TNT to desired surface morphologies by simply manipulating the electrochemical parameters for wide applications such as solar energy conversion and photoelectrocatalysis.

Keyword: Titania; Nanotubes; Morphology; Photoelectrochemical.