

Effect of voltage on TiO₂ nanotubes formation in ethylene glycol solution

ABSTRACT

The crystalline phase of the TiO₂ nanotubes without further heat treatment were studied. The TiO₂ nanotube arrays were produced by anodization of Ti foil at three different voltage; 10, 40, and 60 V in a bath with electrolytes composed of ethylene glycol (EG), ammonium fluoride (NH₄F), and hydrogen peroxide (H₂O₂). The H₂O₂ is a strong oxidizing agent which was used as oxygen provider to increase the oxidation rate for synthesizing highly ordered and smooth TiO₂ nanotubes. Anodization at voltage greater than 10 V leads to the formation of tubular structure where higher anodization voltage (~ 60V) yield to larger tube diameter (~ 180 nm). Crystallinity of the nanotubes is improved as the voltage was increased. The transformation of amorphous to anatase can be obtained for as anodized TiO₂ without any heat treatment. The Raman spectra results show the anodization at 40 V and 60 V gives anatase peak in which confirms the crystalline phase. The stabilization of the crystalline phase is due to the oxygen vacancies and ionic mobilities during the anodization at high voltage.

Keyword: TiO₂ nanotubes; Anodization; Crystallization; Anatase