

# **BaTiO<sub>3</sub>-TiO<sub>2</sub> nanotubes produced by classical hydrothermal method and their photoelectrochemical properties**

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## **Abstract**

Nanotubes are of great interest due to their high surface-to-volume ratios and size-dependent properties. Titanium dioxide nanotube array is a well-known nanostructured semiconductor oxide with improved functional photocatalytic and sensing properties. Considering these properties, TiO<sub>2</sub> NTs arrays attract wide scientific interest in view of their applications in self-cleaned gas sensors, photo catalytic materials, dye sensitized solar cells, and water photo electrolysis. In this work, TiO<sub>2</sub> nanotubes were prepared by anodization of pure titanium sheets and subsequently covered with BaTiO<sub>3</sub> using classical hydrothermal method (200 °C during 2 hours). The TiO<sub>2</sub> nanotubes were prepared using 2wt. % NH<sub>4</sub>F in ethylene glycol and water under constant voltage 40 V for 4 hours. Thereafter, the prepared samples were hydrothermally processed in a solution of 0.004, 0.006, 0.008 M Ba(OH)<sub>2</sub> respectively, and preheated distilled water in classical oven. Different techniques of analysis such as X-ray Diffraction (XRD), Raman Spectroscopy and Scanning Electron Microscopy (SEM) were used to characterize the obtained layers. The formation of BaTiO<sub>3</sub> was confirmed by Raman analysis. SEM image of these layers showed the coverage of TiO<sub>2</sub> nanotubes by BaTiO<sub>3</sub> nano-particles.

**Key words:** TiO<sub>2</sub> nanotubes, anatase, rutile, BaTiO<sub>3</sub>-TiO<sub>2</sub> anodization, Hydrothermal method.