

Nanotubos de TiO₂ auto dopados e decorados com nanopartículas de Pt para aplicação em células à combustível foto-assistida direta de álcool

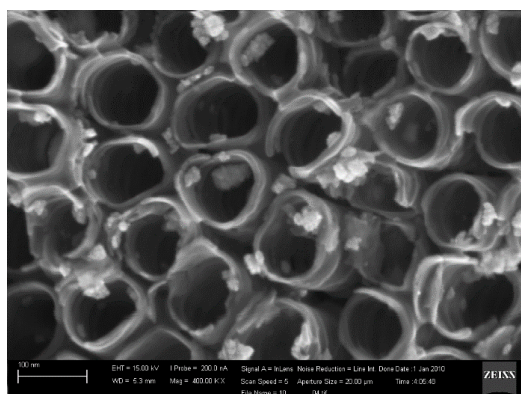
Self-doped TiO₂ nanotubes decorated with Pt nanoparticles for application in photo-assisted direct alcohol fuel cells

G. G. Bessegato⁽¹⁾ and G. Tremiliosi-Filho^(2*)

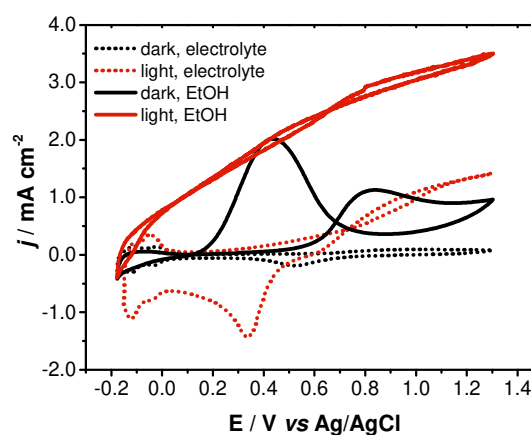
⁽¹⁾State University of Western Paraná (Unioeste), Toledo, PR, Brazil

⁽²⁾Institute of Chemistry of Sao Carlos, University of São Paulo, São Carlos, SP, Brazil

Abstract: TiO₂ nanotubes (TNT) electrodes were prepared on Ti foil by potentiostatic anodization (20 V for 2 h) in 1.0 mol L⁻¹ NaH₂PO₄/0.3% HF solution and annealed in air at 400 °C for 2 h. The self-doping of TNT (SDTNT) was carried out by cathodic polarization in 0.1 mol L⁻¹ KH₂PO₄ buffer electrolyte under different potentials: -1.5 V, -2.0 V and -2.5 V vs Ag/AgCl for 1 and 5 min. Platinum-decorated SDTNT (Pt-SDTNT) show the formation of self-aligned nanotubes perpendicular to the metallic substrate with an average diameter of 95 nm, tube wall of 14 nm, length of 1100 nm and platinum nanoparticles of 3.3 ± 0.6 nm are formed in the top, inside and outside the SDTNT, (Fig (a)), with a band gap of 3.04 eV and a density of charge carriers of 1.5 x 10²⁰ cm⁻³. Fig. (b) shows the voltammograms for Pt/SDTNT in dark and under irradiation, in the absence and presence of ethanol. The large increase of the photocurrent in the presence of ethanol in relation to the voltammogram in the absence of ethanol is explained by the effect called "current doubling". This increase is due to the injection of additional electrons in the conduction band of TiO₂ from the oxidation of ethanol by the photogenerated h⁺. The Pt-SDTNT is an interesting starting point for the development of photoanodes for application in photo-assisted fuel cells.



(a)



(b)

(a) FEG-MEV image of vertically oriented Pt decorated self-doped TiO₂ nanotube sample.
 (b) Cyclic voltammograms for Pt-SDTNT in 0.5 mol L⁻¹ H₂SO₄ and in the presence of 0.5 mol L⁻¹ ethanol under irradiation and in the dark.

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* e-mail: germano@iqsc.usp.br