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**Electrochemical and photoelectrochemical properties of the interface
between titania nanotubes covered by conducting polymer in aqueous
electrolytes – the effect of various geometry and electrolytes
concentration**

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ABSTRACT

In the present work we show the impact of nanotubes (NTs) geometry of titania utilized as a substrate in organic-inorganic systems acting as a p-n junction on efficient conversion of radiation energy into electrochemical energy. The electrolytic bath composition and electrolysis conditions were controlled in order to obtain TiO₂NTs of various geometry as a result of electrochemical oxidation of titanium foil. The electrode material was characterized using scanning electron microscopy, Raman and UV-vis spectroscopies in order to investigate their morphology, crystallinity and absorbance ability, respectively. According to SEM inspection, the electrolyte bath composition (water content) and duration of electrolysis significantly affects TiO₂NTs morphology, namely the internal diameter and the layer thickness. The TiO₂NTs electrode/electrolyte interface characterized using electrochemical impedance spectroscopy (EIS) exhibits varied impedance parameters depending on the outer K₂SO₄ electrolyte concentration (in the range of: 0.01 - 0.2 M) as the electric charge distribution at the interface is concentration dependent. The series of hydrogenated titania substrates were electrochemically modified by the conducting polymer: poly(3,4-ethylenedioxythiophene) doped with polystyrene sulphonate (pEDOT:PSS) thin film. The optimal geometry of titania was determined based on the photocurrent density recorded for the composite material (TiO₂NTs/pEDOT:PSS). The most photoactive organic inorganic

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