Influence of anodic etching on carbon fiber substrate for TiO_2 deposition from $TiCl_3$ anodic hydrolysis

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Carbon fiber (CF)/TiO_2 composites appear as a very interesting electrode for photoelectrochemical processes to environmental applications, especially for the abatement of organic species in wastewater [1]. In this work, anodic pre-treatments on CF produced at heat treatment temperature of 1000 ºC were systematically studied. Emphasis was given in the influence of oxygen functional groups on the CF surface in the anodic hydrolysis of $TiCl_3$ for obtaining TiO_2/CF composites. The CFs were anodically polarized using 0.5 mol L^{-1} H_2SO_4 in a fixed potential of 2.0 V *vs* Ag/AgCl/KCl for 5, 10, 20 and 30 min to control the amount of oxygen as well as the type of carbon-oxygen groups on the CFs surfaces. The TiO_2 electrodeposition on CF1000 was performed under potentiostatic mode, at a fixed potential of 0.75 V during 30 min in a 5 mmol L^{-1} $TiCl_3$ (pH=2) + 0.01 mol L^{-1} KCl aqueous solution. Morphological, structural, and surface chemical changes were investigated by Scanning Electronic Microscopy with field emission guns (SEM-FEG), X-ray diffraction (XRD), Raman spectra, and X-ray photoelectron spectroscopy (XPS). XRD patterns did not present significant structural changes whereas Raman analyzes showed that the I_D/I_G ratio decreased as function of anodization time as well as the FWHM concerning G band also decreased for anodization time of 30 min. XPS showed that oxygen functional groups particularly C-OH was more preeminent for anodic polarization of 30 min. For all substrates analyzed was TiO_2 deposition obtained successes with defined by TiO_2 Raman spectra. The SEM images showed the deposition of a very thin TiO_2 film. With an anodic polarization time increase, TiO_2 thickness also increased. This behavior may be associated to C-OH functional group present on CF1000 surface, enhancing the TiO_2 deposits.

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References:

[1] Z. Wang, K. Yoshinaga, X.R. Bu, M. Zhang, Jounal of Hazardous Materials, **290**, 134 (2015)