The Photoinduced Activity of Ni-TiO₂/TiO₂ Multilayer Nanocomposites Synthesized by Pulse Electrodeposition Technique

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The sol-enhanced pulse plating (PP) technique was utilized to deposit the Ni-TiO₂/TiO₂ multilayers on copper substrates from a Watts bath containing a TiO₂ sol, and the obtained coatings were heat treated at various temperatures. The characteristics of coatings were examined using scanning electron microscopy (SEM), X-ray diffraction (XRD), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), and UV-visible spectrophotometry. In order to estimate the wettability of these nanostructured multilayers after exposure to UV light, the contact angle of water droplets were measured, and the photocatalytic (PC) efficiency of the multilayers were analyzed by the degradation of methyl orange (MO). The photoelectrocatalytic (PEC) activity of multilayer coatings for the decomposition of phenol was determined, and various potentials were applied to optimize the degradation efficiency under UV illumination. It was found that the multilayer heated at 450 °C not only exhibited the greatest light-induced hydrophilicity, but also possessed the highest PC activity. This was justified on the basis of the highest percentage of the anatase phase present in the coating heated at 450 °C, along with the maximum amount of absorbed hydroxyl groups as well as considerable roughness. The PEC efficiency of this multilayer was 97.22% for the degradation of phenol under the anodic potential of 600 mV along with 2h of simultaneous UV illumination.

Keywords: Pulse-plating, Ni-TiO₂/TiO₂ multilayers, Photoinduced hydrophilicity, Photoelectrocatalytic degradation

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