Functionalized TiO₂ Nanotubes as Three-Dimensional Support for Loading Au@Pd Nanoparticles: Facile Preparation and Enhanced Materials for Electrochemical Sensor

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A new composite nanostructure made of unique TiO₂-based nanotubes (TiO₂NTs) and coating 3-Aminopropyltrimethoxysilane (APTMS) anchor Au@Pd nanoparticles (Au@Pd NPs) has been demonstrated. APTMS covalent bonding of its functional silane groups onto the surface of hydrophilic TiO₂NTs crystals, meanwhile APTMS acted as a linker, which provided metal-ligand bonding and hydrogen bonding interaction with Au@Pd NPs, resulting in the formation of Au@Pd NPs/f-TiO₂NTs hybrid nanostructures. The resulting Au@Pd NPs/f-TiO₂NTs hybrid nanostructures were characterized by SEM, TEM and Nitrogen adsorption-desorption isotherms and the results suggest the existence of the uniform distribution of Au@Pd NPs on the TiO₂NTs surface with the help of APTMS. Moreover, the hybrid nanostructures were used as a promising catalyst in nonenzymatic electrochemical sensor because of its satisfactory or even enhanced electrocatalytic properties from both Au@Pd NPs and TiO₂NTs. The electrochemical results indicate that as-prepared Au@Pd NPs/f-TiO₂NTs hybrid nanostructures modified glassy carbon electrode (GCE) exhibits high electrocatalytic activity toward H₂O₂ at low potential, the detection limit for H₂O₂ were found to be 2×10⁻⁸ M (S/N=3).

Keywords: TiO₂ nanotubes, APTMS, Au@Pd NPs/f-TiO₂NTs hybrid nanostructures, Nonenzymatic electrochemical sensor, H₂O₂

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