Fotodeposition of Bimetallic Au-Pt Nanoparticles on the Electrodeposited TiO₂ Nanotube Arrays for Efficient Visible Light-Driven Photocatalytic Performance

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In this work, well-ordered TiO₂ nanotube arrays (TNTAs) were successfully prepared by a facile electrochemical anodization, and the Au-Pt bimetallic nanoparticles were then deposited on the TNTAs surface for improving their photocatalytic properties. The experimental results reveal that the Au-Pt nanoparticles with the size of ~2 nm were well distributed on the surface of TNTAs, and the Schottky heterojunction was formed at the interface between the Au-Pt nanoparticles and TNTAs. Compared to the pristine TNTAs and monometallic Au/TNTAs or Pt/TNTAs, the Au-Pt/TNTAs exhibited significantly improved photocatalytic activities for rhodamine B (RhB) degradation. The photocatalytic degradation rate constant (*k*) of the Au-Pt/TNTAs was calculated to be ca. 1.0884 h⁻¹, which was about 3.7 times that of TNTAs and was also greater than the sum of the Au/TNTAs and Pt/TNTAs. The enhanced photocatalytic activities could be ascribed to the synergistic effects of Au-Pt/TNTAs: (1) the largely improved optical absorption abilities induced by the surface plasma effect of Au-Pt nanoparticles, and (2) the accelerated separation and migration process of photogenerated carriers arising from the Schottky heterojunction at the interface between Au-Pt and TNTAs.

Keywords: TiO₂ nanotube arrays (TNTAs); Bimetallic Au-Pt nanoparticles; Schottky heterojunction; Photocatalytic performance; Photocatalytic mechanism

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