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Nanodiamond-supported crystalline TiO_2 nanoparticles synthesized *via* one-step isothermal hydrolyzing method and its nitrite electrooxidation

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Titanium dioxide (TiO_2) is well known as a semiconductive oxide that has attracted substantial attention because of its applications in photocatalysts. Decorating TiO_2 nanoparticles on nanocarbon substrate can prevent the nanoparticles from aggregation, increasing the active specific area and raising the utilization rate of TiO_2. Unlike the commonly used sp^2-bonded carbon materials, Nanodiamond (ND) with sp^3 bond has more outstanding thermal stability and oxidation resistance. As most of the synthetic methods for achieving crystalline TiO_2 require high temperature heat treatment under aerobic atmosphere, it may cause damage to the nanocarbon support material. Our previous research showed that compared with other methods, the isothermal hydrolyzing procedure can directly obtain crystalline metal oxide from aqueous solution without annealing. In this study, we used this simple and soft one-step method to prepare ND-supported crystalline TiO_2 nanoparticles (TiO_2/ND). The morphology, structure, and composition of the composites were characterized with X-ray diffraction (XRD), high-resolution transmission electron microscopy (HRTEM), and selected area electron diffraction (SAED). The electrochemical catalytic performance of TiO_2/ND for nitrite was investigated with electrochemical experiments. The nanocomposites displayed a unique feature of having NDs inside and crystalline TiO_2 nanoparticle coatings on the surface of the ND powders. The phase, structure, and thickness of the TiO_2 coating could be adjusted by the reaction time. The electrochemical results indicated that the TiO_2/ND prepared by hydrolyzing for 16 h exhibited higher electrocatalytic activity than the others. And the catalytic ability of the nanocomposites was higher than those of the initial ND and P-25 TiO_2 towards the oxidation of nitrite.

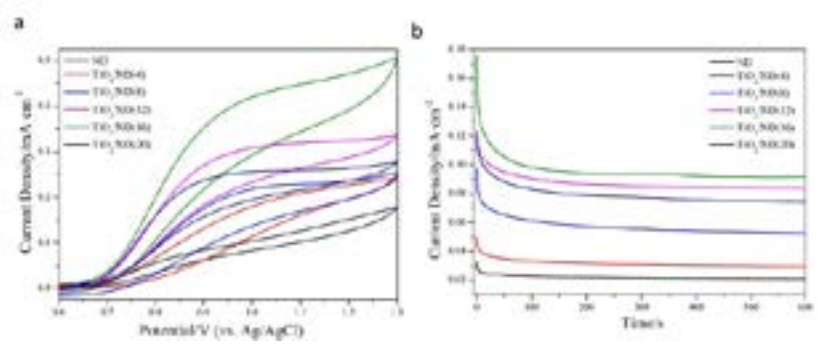

Figure 1. (a) CV curves in 0.1 M PBS (pH=7) + 5 mM NO2- solution for the initial ND, TiO_2/ND hydrolyzed for 4, 8, 12, 16 and 20 h at 50 mV/s. (b) i-t curves in 0.1 M PBS (pH=7) + 5 mM NO2- solution for initial ND, TiO_2/ND hydrolyzed for 4 , 8, 12, 16 and 20 h

Biography

Xipeng Xu is President of Huaqiao University. He has his expertise in machining technology and functional usage of diamond materials. He is executive member of International Committee for Abrasive Technology (ICAT) and gets over 140 technical papers publication in related journals and conference.

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