Synthesis and Characterization of Silver-Modified Micro-Diamond as an Electrocatalyst for Oxygen Evolution and Reduction Reactions in Alkaline Medium

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Silver-modified micro-diamond composites are synthesized through the chemical reduction of silver nitrate and characterized via X-ray diffraction, scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy, and Raman spectroscopy. SEM and TEM images show that silver nanoparticles 10–30 nm in size are uniformly deposited on the surface of the micro-diamond. Electrochemical properties are investigated through cyclic voltammetry, linear sweep voltammetry, and electrochemical impedance spectroscopy. Results show that 10 wt% Ag/Dia (silver content is 10% of the diamond) exhibits better bifunctional performance than the commercial Pt/C (20 wt% Pt on carbon) electrocatalyst under the same testing conditions. Compared with pristine micro-diamond and nanodiamond, 10 wt% Ag/Dia demonstrates lower onset potential and higher current density during oxygen reduction reaction and oxygen evolution reaction. The electron transfer number of 10 wt% Ag/Dia is approximately 3.987 at -0.08 V, which indicates that the reaction is almost dominated by an efficient $4e^-$ process. The satisfactory performances of the composites provide a novel potential application for electrochemistry.

Keywords: silver; micro diamond; oxygen reduction reaction; oxygen evolution reaction; electrocatalyst.

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