Abstract

This study investigates the preparation of Pd/h-BNNSs/rGO composites and their application in ethanol electro-oxidation sensors. It begins with an introduction to direct ethanol fuel cells (DEFCs), highlighting the requirements for anode materials. The advantages of palladium (Pd) and platinum (Pt) as catalytic metals, along with the significance of carbon materials in catalysis, are discussed. This research innovatively integrates h-BN nanosheets with graphene oxide to develop a distinctive two-dimensional nanocomposite material, successfully loading Pd onto it for enhanced ethanol oxidation.The experimental section outlines the material preparation process, which includes synthesizing graphene oxide (GO), preparing h-BNNSs/rGO, and fabricating Pd/h-BNNSs/rGO composites. The structure and morphology of these composites are characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive spectroscopy (EDS). These analyses confirm the successful construction of the h-BNNSs/rGO composite and uniform loading of Pd. Additionally, Fourier-transform Raman spectroscopy (FT-Raman) and Fourier-transform infrared spectroscopy (FT-IR) further validate the structural characteristics.In electrochemical testing, 15% Pd/h-BNNSs/rGO demonstrates superior performance in alkaline environments compared to commercial Pd/C catalysts, exhibiting enhanced ethanol oxidation activity, greater electrochemical stability, and improved CO tolerance. Results from cyclic voltammetry and chronoamperometry corroborate these findings, indicating promising applications for this composite in ethanol electro-oxidation sensors. This study provides valuable insights for future research on sensors within ethanol fuel cells while contributing to advancements in high-performance ethanol electro-oxidation sensor technology.