

Role of Grain Boundaries in Oxygen Reduction Reaction within Pt-Co Nanowires

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In this research, we explore the effect of grain boundaries (GBs) on the oxygen reduction reaction (ORR) in Pt-Co nanowires. Grain boundaries are imperfections in crystal structures and are typically considered highly active sites for various electrochemical processes. However, our results indicate that GBs in bimetallic Pt-Co alloys may not be beneficial. To investigate this, we synthesized Pt-Co nanowires containing GBs (Pt-Co GB-NWs) and single-crystalline Pt-Co nanowires without GBs (Pt-Co SC-NWs) as model catalysts, ensuring both types had comparable Pt/Co ratios, diameters, and Pt-rich surface structures, differing only in the presence of GBs. Through in-operando coupled plasma mass spectroscopy, we discovered that GBs in Pt-Co nanowires accelerate the leaching of Co atoms during the activation process. Furthermore, Pt-Co GB-NWs, which exhibited more Co leaching, demonstrated only half the ORR activity compared to Pt-Co SC-NWs. This suggests that GBs serve as defect sites that disrupt the surface alloy composition during ORR. These findings imply that preserving the crystal-structural integrity could be a promising strategy to enhance the ORR performance of Pt-based alloy materials, especially in one-dimensional structures such as nanotubes and nanowires

Paper submission Plan

Best Presentation

Contribution track

ICABU WG4. Applications of Particle Beams

Primary author: KIM, jungki (kyungpook national university)

Co-author: CHOI, Sang-il (Department of Chemistry and Green-Nano Materials Research Center, Kyungpook National University, Daegu 41566, Korea)

Presenter: KIM, jungki (kyungpook national university)

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