

Charge transfer highway in bicontinuous nanoporous core-shell iridium/iridium oxide for oxygen evolution reaction

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The selection of oxide materials for catalyzing the oxygen evolution reaction in acid-based electrolyzers must be guided by the proper balance between activity, stability and conductivity—a challenging mission of great importance for delivering affordable and environmentally friendly hydrogen. Here we report that the highly conductive nanoporous architecture of an iridium oxide shell on a metallic iridium core, formed through the fast dealloying of osmium from an Ir<sub>25</sub>Os<sub>75</sub> alloy, exhibits an exceptional balance between oxygen evolution activity and stability as quantified by the activity–stability factor. On the basis of this metric, the nanoporous Ir/IrO<sub>2</sub> morphology of dealloyed Ir<sub>25</sub>Os<sub>75</sub> shows a factor of ~30 improvement in activity–stability factor relative to conventional iridium-based oxide materials, and an ~8 times improvement over dealloyed Ir<sub>25</sub>Os<sub>75</sub> nanoparticles due to optimized stability and conductivity, respectively. We propose that the activity–stability factor is a key “metric” for determining the technological relevance of oxide-based anodic water electrolyzer catalysts.