Enhanced Electrocatalytic Water Oxidation by Shaped Ir-Ni Bimetallic Nanoparticles

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Recently, there are much attentions to electrocatalytic water splitting due to the storage of intermittent renewable energies and the production of the highly pure hydrogen gas. However, the significant overpotential at the anode reaction, oxygen evolution reaction (OER), is the main obstacle. The development of efficient electrocatlayst which can endure highly corrosive environment is an urgent issue. We report a facile synthesis of various shaped Ir-Ni bimetallic nanoparticles for oxygen evolution reaction. The shapes are adjusted by varying Ir to Ni molar ratio of the each metal precursors. When the Ir/Ni ratio is 0.38, about 20 nm rhombic dodecahedral nanoparticles are obtained. Because the Ir thin layer are formed on to the Ni core, the particles are denoted as Ir-Ni TL. When the amount of the Ir precursors increases, Ir is selectively located at the vertex sites and the shape is changed to star-candy shape (denoted as Ir-Ni SC) and Ir lump with Ni core shape (denoted as Ir-Ni LP). These bimetallic nanoparticles show enhancement in both electrocatalytic activity and durability toward the water oxidation reaction. The Ir mass activity is greatly enhanced by 3.8 and 7.8 times relative to that of the 2 nm Ir nanoparticles and Ir black respectively.