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Platinum Ruthenium Core-shell Nanoparticles for H2 oxidation kinetics in alkaline media

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As people concern about environment and clean energy production, hydrogen-based fuel cell attracts more and more attention of scientists. However, the rate of the hydrogen oxidation reaction (HOR) in the alkaline media is usually slow which limits the development of this promising energy source. Recently, a new type of catalyst—Pt0.1Ru0.9 was found to give a high activity for the HOR, which is the maximum activity people achieve now (about 5 times more than Pt).
One hypothesis for the high catalytic efficiency of Pt0.1Ru0.9 materials is the "Binding Energy"theory. It could be explained that when Pt and Ru form the alloy, the interaction between the two metal atoms will cause the different electrochemical behavior from the pure material. While another hypothesis for the high activity is the "Bifunctional Effect"theory. Ru could capture OH in the alkaline media, which can can simultaneously provide active sites for the dissociative adsorption of H2 and adsorption of reactive OH on the top of Ru-Pt atoms.
To explore more about the new, successful material, a Pt@Ru core-shell structure is designed to demonstrate the causes of the high activity. Compared the novel Pt materials, Ru could largely decrease the cost of novel Pt production if the electrochemical characteristic of Pt is not influenced by the Ru core. More importantly, avoiding the attachment of Ru from OH-, we can easily figure out either "Binding Energy"theory or "Bifunctional Effect"theory is more convincing with the H2 oxidation reaction result in alkaline media.

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