Stability of Palladium and Platinum-based Oxygen Reduction Electro catalysts in Alkaline Solutions

By

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Abstract

Platinum (Pt) and Palladium (Pd)-based metals are the most active electrocatalysts toward oxygen reduction reaction (ORR) in both proton exchange membrane fuel cell and alkaline fuel cell. The stability of these catalysts during fuel cell operation determines the life of fuel cells. It has been found that the Pt nanoparticles supported on carbon (Pt/C) was less stable in alkaline solutions than that in acids. The stability of Pd-based catalysts, which are more active for ORR than Pt-based ones in alkaline media has been rarely studied. This study focuses on the systematic study on the stability of Pd/C and Pd alloy/C in alkaline solutions and comparing it with the Pt-counterpart.

The commercial Pt/C and Pd/C nanoparticles were chosen as model catalysts to evaluate the durability in 0.1 M NaOH solutions under various electrochemical testing conditions. The change in terms of half-wave potential and electrochemical surface areas were compared after 100, 500 and 2500 cycles. It was found that the Pd/C had a much better durability than Pt/C under the same conditions. Alloying Pt and Pd with other transition metals (Fe, Co and Ni) was also attempted. The alloys showed much higher activity and stability.

In addition, the mechanisms of activity decay were also studied by advanced characterization techniques including identical location transmission electron microscope (IL-TEM), in situ Fourier-transform infrared spectroscopy (FTIR), and online inductively coupled plasma mass spectrometer (ICP-MS). This study provided new insights and guidelines in the design of more advanced electrocatalysts for oxygen reduction reaction in alkaline solution.

Date: 26 November 2018 (Monday)
Time: 15:00
Venue: Room 3598 (Lifts 27-28)

Examination Committee:
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