Well-Dispersed Surfactant Stabilized Nanocatalysts: pH Effects and Mechanism Investigation

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Polymer electrolyte fuel cell (PEFC) is promising to be the future power generator for consumer electronics and automobiles because of its high energy density and low temperature operation. Among the unsettled technical challenges, low catalyst utilization and long term durability and stability of noble metal based catalysts continue to be the factors that delay PEFCs from a large scale commercial deployment. Previously, our group has reported synthesis protocols for the nanoscale carbon supported Pt and alloy catalysts using surfactant dodecyldimethyl (3-sulfo-propyl) ammonium hydroxide (SB12) as a stabilizer [1].

In this study, we report pH effects to the synthesis of surfactant stabilized nanocatalysts. It was found that the dispersion of catalysts is greatly influenced by the pH condition and the distribution of catalysts is much improved in a neutral or alkaline environment, as evidenced by Figs 1a and 1b. A similar synthesis protocol was applied to the synthesis of Pt catalysts supported on multi-walled nanotubes (MWNTs). 2-3 nanometer catalysts well dispersed on the MWNT shells can be achieved (figure not shown).

Using physical and electrochemical characterization techniques, how the catalyst stabilization is influenced by the pH values will be investigated. Fig. 2 reveals that the electrochemical performance of high pH electrocatalyst is better than that of electrocatalyst prepared at low pH environment.

[1] X. Wang and I-M. Hsing "Surfactant stabilized Pt and Pt alloy electrocatalyst for polymer electrolyte fuel cells", *Electrochimica Acta,* 47, 2981-2987 (2002)

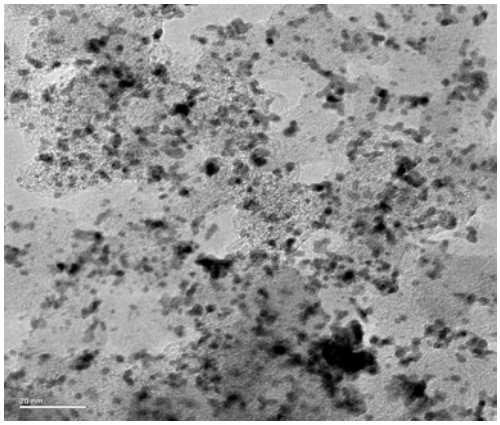

Fig. 1a. TEM image of SB12 stabilized catalysts at pH6.

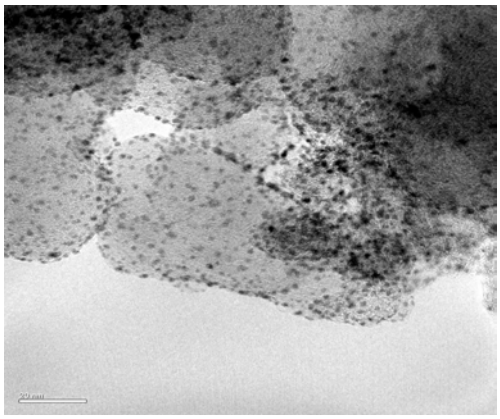

Fig. 1b. TEM image of SB12 stabilized catalysts at pH9.

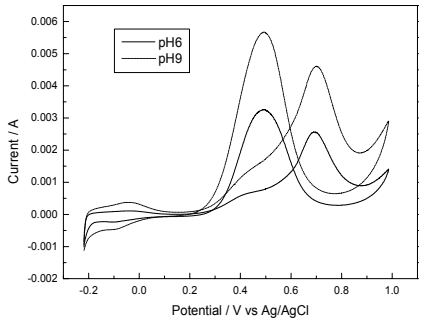

Fig. 2. CV of surfactant stabilized Pt/C synthesized at pH6 and pH9 in 1M $HClO_4$ + 1 M CH_3OH solution.