Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

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"Novel Noble Metal Based Anode Catalysts for Direct Methanol Fuel Cells"

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11:00 A.M. Seminar in Baker Hall 136A
Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall

Direct methanol fuel cells (DMFCs) generally have a simple design, higher reliability, and are cost-effective when compared to hydrogen fuel cells. DMFCs are also attractive because they use liquid methanol fuel, which is easily stored and transported. However, there are major challenges that must be overcome before DMFCs will become viable in the world market. These include methanol crossover, which can only be overcome by developing new membranes, and the slow anode kinetics which can only be overcome by developing new anode catalysts.

New, high surface area catalyst materials, including noble and non-noble metals, need to be identified to overcome the problems of current anodes. It is believed that high surface area nanoparticles of select alloy systems will likely offer solutions to these problems. While several bimetallic alloy systems have been investigated (PtSn, PtMo, PtOs, PtW, PtNi, and the best to date PtRu) recent work on thin film quaternary alloys, specifically PtRuNiZr, exhibit promising results. However, to date, there has not been any reported work done on high surface area powders of these multi-metal alloy systems.

A novel noble metal based alloy system with reduced noble metal content has been investigated that shows promise for use as an anode catalyst for direct methanol fuel cells. Previous report on a quaternary Pt-Ru based alloy by Whitacre *et. al*., showed promising results. In the present study, a sol-gel complexation approach has been extended for synthesizing novel quaternary alloys following this initial report. The sol-gel derived precursor powders when thermally treated yield a high surface area (~127 m^2/g) catalyst. XRD analysis shows the formation of nearly homogeneous, single phase alloy. Preliminary electrochemical half-cell data indicates a promising current response for oxidation of methanol. Results of these initial studies on these new alloy systems will be presented and discussed.

Nick received his Bachelors degree in Materials Science and Engineering from Alfred University in 2003 and his Masters degree in Materials and Science and Engineering from Carnegie Mellon University in 2005. He is currently a Ph.D. candidate under the guidance of Prof. Kumta.