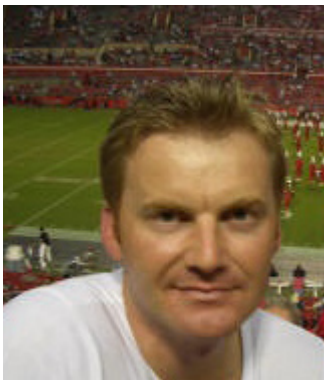
T_CSUH Bi-Weekly Brown Bag Seminar

Texas Center for Superconductivity at the University of Houston

Dr. Peter Strasser

Department of Chemical and Biomolecular Engineering,
at the University of Houston



"Lattice-strained Nanoparticle Electrocatalysts for PEMFC Cathodes –From Combinatorial Discovery to Structure-property Relationships"

Friday, September 29, 2006

Room 102, University of Houston Science Center
12:00 noon – 1:00 p.m.

Abstract

The cell voltage and performance of Polymer-Electrolyte-Membrane Fuel Cells (PEMFCs) deviate strongly from their theoretical values due to severe kinetic overpotentials at the cathode where oxygen is electroreduced to water. The overpotentials are a manifestation of the sluggish rate of adsorption and reaction of molecular oxygen on Pt cathode electrocatalysts. The identification of more active, cost-effective and corrosion stable electrocatalysts for the oxygen reduction reaction (ORR) therefore continues to be a scientific priority in Fuel Cell catalysis research.

We report the combinatorial discovery, bulk synthesis and physico-chemical characterization of a new structural class of Pt electrocatalysts for use for the ORR in PEM fuel cell cathodes. The catalysts exhibit outstanding performance characteristics in terms of their Pt mass based as well as their Pt surface specific activity for the ORR, meeting Department of Energy performance targets for 2010.

Electrochemical Rotating Disk Electrode (RDE) measurements and physico-chemical characterization - including synchrotron X-ray diffraction (XRD) and synchrotron Small Angle X-ray Scattering (SAXS) - show that rapid de-alloying and corrosion processes of base metal rich alloy nanoparticles of a catalyst precursor compound result in the formation of Pt particle lattices with unusually high lattice strain. The data suggests that the formation of strained Pt lattices is correlated with the favorable catalytic activity. SAXS results further show how the electrochemical treatment affects the particle size and metal composition distributions of the catalytic particles inside their ionomer-carbon matrix. Our synchrotron studies allow us to formulate relationships between synthetic conditions, structural characteristics and electrochemical activity. Experimental observations are compared to DFT computational predictions as to the impact of strain on the ORR activity of Pt lattices.

Dr. Peter Strasser is Assistant Professor at the Department of Chemical Engineering at the University of Houston. His current work focuses on catalytic nanomaterials, electrochemical energy conversion, hydrogen and direct liquid fuel cells as well as bio electrochemistry. Research thrusts include the synthesis and the in-situ characterization of electrocatalytic reactivity as well as the size and composition dynamics of multi-metallic particle catalysts using synchrotron-based X-ray methods.

Before joining the ChemE department, Dr. Strasser served as Senior Member of staff at Symyx Technologies, Inc, Santa Clara, in the Electronic Materials and Heterogeneous Catalysis Group. Symyx Technologies is the technology leader in the development and application of high throughput experimentation in Material Science.

Prior to joining Symyx, he did his doctoral research work at the 'Fritz-Haber-Institute of the Max-Planck-Society', Berlin, Germany, under the direction of Professor Gerhard Ertl, and received his Ph.D. in Physical Chemistry and Electrochemistry in 1999. In the same year, he was awarded the 'Otto-Hahn Research Medal' for the 'most outstanding dissertation in the year 1999' by the Max-Planck Society for his research on non-equilibrium self-organization and spatio-temporal pattern formation on electrified interfaces.

In 1996, Dr. Strasser was visiting scientist with Sony Central Research, Yokohama, Japan. He studied chemistry at the University of Tuebingen, Germany (1988-1995), Stanford University (1991-1992), and University of Pisa, Italy (1992-1993), and received his diploma degree (MS) in chemistry in 1995.

He has approximately 36 journal publications, holds 20 patents/patent applications, had over 35 invited talks and has recently edited a book on 'High Throughput Screening in Catalysis'.

Persons with disabilities who require special accommodations in attending this lecture should call (713) 743-8210 as soon as possible.

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