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Ir and Pt Nanoparticles as Electrode Materials: Nanoscale but Megapotential.

Dr. Viola Birss

Canada Research Chair
(Electrochemistry of Materials for Fuel Cells and Related Energy Applications)

Department of Chemistry
University of Calgary
Calgary, Alberta Canada

Metal nanoparticles, deposited as thin films on conducting substrates, are of great interest in a wide range of applications, including as electrocatalysts, in nanosensors, and in nanotechnology, in general. Pt is of particular interest to us due to its fuel cell applications, while Ir-based electrodes are used in supercapacitive and electrochromic devices, as well as for the electrocatalysis of chlorine and oxygen evolution. This presentation will include a discussion of our efforts to establish the mechanism of Ir and Pt nanoparticle formation, achieved by the reduction of Ir and Pt salts with sodium ethoxide. It has also been found that Ir nanoparticles can easily be oxidized to form a hydrous Ir oxide film, which is highly porous, conductive, and biocompatible. These films can then be used as a matrix for the entrapment of the redox-active enzyme, glucose oxidase (GOx), allowing the electrode to be used as a glucose sensor for the treatment of diabetes. Evidence for the direct regeneration of the active site of GOx through the Ir(III)/(IV) oxide redox chemistry at the Ir oxide nanoparticles will be shown. Pt and Ir nanoparticles can also be mixed together, and are found to be active in the electrocatalysis of methanol oxidation at room temperature. The activity of these mixed Pt-Ir electrodes is highest when they are dried at 250°C, while conversion of the Ir nanoparticles to Ir oxide causes a significant loss in methanol oxidation activity.