

### **Tin Nano-Rods as Support for Direct Methanol Fuel Cells**

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Fuel cells are considered as efficient devices for energy conversion. The state of the art catalysts, on which the fuel is oxidized to release protons which further react with oxygen to produce water and electrical energy, are based on the noble and costly metal Platinum. One of the other major problems which causes direct methanol fuel cells (DMFC) potential drop, hence a decrease in their power density, is the mass transport through the anode, i.e. fuel flow and gaseous reaction product CO<sub>2</sub> removal.

These problems may be addressed by the production of three dimensional electrodes based on porous carbon back support, Tin nano-rods and Pt nano-catalyst. This structure will increase the catalyst effective surface area, and provide improved mass flow conditions for enhanced fuel utilization and CO<sub>2</sub> removal from the cell. Sn and SnO<sub>x(x=1-2)</sub> are known for their enhancing effect on methanol oxidation by mitigating the CO poisoning effect of platinum catalysts and may provide a support with good conductivity, high specific area for better catalyst dispersion, and improved stability in acid solution by the SnO<sub>x</sub> passivation outer layer. By using this approach, Pt content in the anode may be considerably reduced, thus making DMFC systems commercially attractive.

The metallic Tin nano-rods with average length of 300nm (180gr/m<sup>2</sup>, BET) were synthesized by a surfactant assisted method with reducing agent at room temperature. In this method the surfactant is used as a templating agent in order to form particles with defined shapes. This preparation method enables the control of important parameters such as high aspect ratio and conductivity of the nano-rods.

Pt nano-catalyst was synthesized on Tin nano-rods by reduction methods with Pt to Sn ratio of 1:1, and characterized by SEM, EDX, ICP, and STA. The electrochemical behavior of this Pt-support system was compared to carbon supported Pt.