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Novel Sol-Gel Approaches to Nanocrystalline Noble Metal Catalyst Nanotubular Structures for Direct Methanol Fuel Cells

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Abstract

Direct methanol fuel cells (DMFC) operate on the principle of directly oxidizing hydrocarbon fuels such as methanol using an electrocatalyst at low temperatures. The electrocatalytic oxidation of the fuel occurs at a potential resulting in the generation of electrons through an external circuit, thus providing energy for running an external device or load. DMFC's are, therefore, direct energy storage devices that do not exhibit the need for regeneration of fuels or recharging cycles as in secondary rechargeable batteries. Furthermore, they operate at low temperatures and the only product generated from the catalytic oxidation is CO_2, which can be recycled back into the system. As such, DMFC is a very safe and powerful energy conversion device that is capable of continuous power and is being targeted as a potential source of power for electric vehicles. DMFC's are also being sought as alternative energy storage devices to lithium-ion batteries for providing power to portable electronic devices such as cellular phones. Thus, DMFC's have tremendous commercial potential in the current market environment.

This project aims to alleviate some of the most prominent problems facing the DMFC technology, which is basically developing a cost-effective process for synthesizing an efficient catalyst. The project will investigate more efficient catalysts to reduce loadings by more than 50%, improving electrochemical performance, one of the major stumbling blocks to commercializing DMFCs. Significant cost benefits to our industry collaborators are envisaged.