
Physics Colloquium

University of Missouri-Kansas City

Department of Physics

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Carbon Nanotubes as PEM Fuel Cell Catalyst Support

Fuel cells are devices that convert chemical energy directly into electricity in highly efficient and environmentally friendly electrochemical processes. Although fuel cells were invented one and a half centuries ago, only recently have they become economically competitive with traditional power systems. Among various fuel cells, proton exchange membrane (PEM) fuel cells are expected to become a viable future power source due to their low operating temperatures, high power density, and rapid response to varying loads. Micro PEM fuel cells also promise to replace lithium-ion batteries to provide long-lasting power for portable electronics. During the past two decades, there have been enormous efforts to advance PEM fuel cell technology. However, many technical problems still need to be resolved before PEM fuel cells can become an affordable power source. Major problems lie in the lack of appropriate materials and efficient manufacturing processes.

One material that has been actively explored in recent years is carbon nanotubes. Studies have shown that this material can be a good support for fuel cell catalysts. In this talk, I will present our work on decorating carbon nanotubes with catalyst nanoparticles for PEM fuel cell applications. We have developed a sonochemical process that allows us to uniformly create surface functional groups on the outer surfaces of multi-walled carbon nanotubes. These surface functional groups are essential in the preparation of highly dispersed metallic nanoparticles on nanotubes. Our results show that the Pt and Pt-Ru nanoparticles supported on carbon nanotubes are much more active in the reduction of oxygen and oxidation of methanol than those supported on the mostly used carbon black. We have demonstrated that carbon nanotubes are more durable than carbon black in electrochemical oxidations.

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****Coffee at 3:10: Colloquium at 3:30 in Room 310****