

Colloquium Notice

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Gold Nanoparticles-Enhanced Proton Exchange Membrane (PEM) Fuel Cell

Proton exchange membrane fuel cells (PEMFC) have attracted great attention because of their high power density, low operation temperature] and almost pollution-free emission . In fuel cells power is generated via the conduction of H⁺ ions through a polyelectrolyte membrane, commonly composed of sulfonated tetrafluoroethylene based fluoropolymer-copolymer. The function of the fuel cell constitutes a balance between hydrogen oxidation and oxygen reduction reactions where Pt nanoparticles are used to catalyze the reactions at the electrodes . Although the hydrogen oxidation process is a fast electrochemical reaction, challenges come up when impure hydrogen is used. Carbon monoxide is well known to poison the catalyst by blocking active sites on the catalyst's surface , which prevents the hydrogen adsorption and subsequent oxidation propane, or alcohols can be an inexpensive alternative to pure hydrogen gas, but the high CO and CO₂ content of reformed gas, even after purification, poses a major drawback. Hence the ability to engineer a CO resistant system would be a critical step towards enabling the commercialization of a competitively priced hydrogen fuel cell. We have developed a technique whereby Au particle nanoplatelets, 3nm in diameter, and only three atomic layers thick, could be reproducibly formed at the air water interface, and then coated onto any arbitrary surface simply by using the LB technique. Here we show that when this layer of NP is deposited directly onto the membrane of a PEM fuel cell, the efficiency of the cell running in ambient conditions is enhanced by more than 80% and an H₂ stream with as much as 20% CO₂ is tolerated. DFT calculations indicate that a two-step oxidation process is also present in this case, which enables the oxidation reaction to take place in a broad temperature range, extending well below ambient.

Monday
November 3, 2014
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326