MRSEC SEMINAR SERIES

Solid acid fuel cell electrode nanostructures - From degradation reaction mechanisms to new design strategies for higher stability

Typical high performance electrodes of electrochemical devices consist of nanostructured materials. However, extremely high specific surface area not only results in a beneficial, high density of electrochemically active sites, but often also entails high degradation rates. Sintering, agglomeration, chemical decomposition as well as side reactions play a role. More specifically in solid acid fuel cell electrodes, functionalized carbon based catalysts and catalyst-support materials are prone to chemical and structural changes as well as carbon corrosion. Here we elucidate the degradation reaction pathways of carbon nanotubes and graphene-like materials with a combined experimental and theoretical study, using impedance analysis and fuel cell measurements under SAFC operating conditions as well as DFT calculations. For enhanced stability, carbon-oxide hybrid materials obtained via a novel low-temperature photochemical synthesis method are shown to be highly promising.

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