MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE — *Physics Colloquium*

Friday, October 9, 2015
4:10 – 5:00 PM
EPS103

Nanomaterials at High Temperatures: Overcoming Thermal Induced Coarsening of Metal Electro-catalysts

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Abstract:
High temperature, heterogeneous catalysis plays a vital role in a host of technologies ranging from automotive catalytic converters and fuel reformation processes to solid state electrochemical devices. Coarsening of nano-metal particulate at elevated temperatures is a significant impediment to the efficiency and longevity of numerous catalyst and energy conversion/storage systems. Utilizing a model high temperature (700 – 900°C) electro-catalyst system of nickel metal-yttia stabilized zirconia (YSZ) doped with metastable aluminum titanate (Al_2TiO_5), we have identified a novel approach to increase the thermal stability of infiltrated nickel by fostering interfacial chemical reactions or 'anchors.' The mechanisms and specific species that confer enhanced catalyst stability through localized reactions are not well understood, however electrochemical testing results indicate that using aluminum titanate as an electrode additive yields retained electro-catalyst performance over 100x the non-treated nano-catalysts. Temperature dependent secondary phase formation has been examined with XRD and Raman Spectroscopy and spatial evolution of the secondary phases is simultaneously studied via SEM/TEM/EDS to establish the species present and their respective spatial distribution during the thermal activation process to elucidate the mechanisms that foster metal catalyst binding. Recent efforts in collaboration with the Environmental Molecular Sciences Laboratory (EMSL) at PNNL have identified Atom Probe Tomography (APT) as a powerful characterization tool to examine nanometer scale interfacial phenomenon. The fundamental basis and methodology for atom probe characterization in addition to recent APT results on the stabilized electro-catalyst system will also be reported.

Host: Rufus Cone

****** Refreshments served in the EPS second floor atrium at 3:45 ******