Research Opportunities in Surface and Materials Sciences at the U. S. Department of Energy's National Energy Technology Laboratory.

The Chemistry and Surface Science Division at the U. S. Dept. of Energy's National Energy Technology Laboratory in Pittsburgh, PA is seeking candidates at all levels to conduct experimental research in surface and materials sciences. Appointments at post-doctoral, research scientist and senior research scientist levels are available through programs with the National Research Council/National Academy of Sciences, Oak Ridge Institute for Science and Education, as well as other sources.

The division has a host of experimental facilities which include: optical spectroscopic laboratories (FTIR, IRRAS, Raman, UV/Vis/NIR), x-ray diffraction equipment, catalyst characterization and testing facilities (TPR, TPO, BET, TPD, TGA/DSC), x-ray photoelectron spectroscopy laboratories, microscopy labs (AFM, SEM), and a newly built surface science laboratory equipped with STM, AFM, XPS, AES, and ISS chambers. All experimental projects benefit from close ties to the division's Computational Chemistry Group as well as formal collaborations with regional universities. Current areas of interest include:

1) **Growth and Characterization of Model Nanocatalysts on Single-Crystal Surfaces:** This project focuses on using classical surface science methodologies like scanning tunneling microscopy, atomic force microscopy, x-ray photoelectron spectroscopy, ion scattering spectroscopy, low energy electron diffraction, and Auger electron spectroscopy to study model nanocatalysts grown on single-crystal surfaces. The effects of size, shape, and defects on the reactivity of these materials are studied. Materials of interest are iron (Fe, Fe_xO_y, Fe_xC_y) and cobalt-based systems for Fischer-Tropsch applications, as well as TiO_2 and other photo- and/or electro-catalysts, which can be used for the reduction of CO_2 in the presence of H_2O. Projects are also possible with fuel cell materials like Lanthanum Strontium Manganate (LSM) or Yittria-stabilized Zirconia (YSZ). A key piece of instrumentation for all of this work is a state-of-the-art ultrahigh vacuum surface science system that houses six distinct analytical methodologies, as well as evaporative growth capabilities.

2) **Synthesis and Characterization of High Surface Area Photo/electro-catalysts:** Other research topics focus on the study of high surface area, powdered, nanocatalysts. Current projects are working on controlling the size and shape of metal nanoparticles in order to tailor their reactivity and selectivity. The shape and size dependent kinetics of simple model reactions like CO oxidation with these nanocatalysts are evaluated using infrared, Raman, and other analytical techniques. Emerging projects in the lab are focusing on nanoparticulate photocatalysts like TiO_2 and developing stable inorganic photosensitizers that can be used for the photoreduction of CO_2 in the presence of H_2O. The lab also has an interest in coupling these photocatalysts with nanocarbons (SWNTs, graphene, etc) in an effort to create a multifunctional sorbent that is capable of adsorbing and reducing CO_2. Key instrumentation for this work includes *in situ* infrared and Raman spectrometers which allow us to probe mechanistic details of reactions these materials catalyze in real time. X-ray photoelectron spectroscopy instrumentation enhances our understanding of the reactivity of these nanocatalysts. Commercial chemisorption instrumentation allows for kinetic studies and general catalyst characterization.

Interested Parties Should Contact:

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