UNIVERSITY OF DELAWARE
DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING
CENTER FOR NEUTRON SCIENCE

WEDNESDAY, APRIL 28 | 10:30 a.m.

SEMINAR followed by Diversity & Inclusion Discussion

Dr. Tabbetha Dobbins

Rowan University | Department of Physics & Astronomy

Join Zoom Meeting
https://udel.zoom.us/j/99444311354 Passcode: MSEGSEM

New Possibilities for Understanding Complex Metal Hydrides via Quasi-Elastic Neutron Scattering (QENS) Studies

The dynamics of hydrogen in 4 mol % $TiCl_3$-doped $NaAlH_4$ which was then confined within the mesoporous SBA-15 was studied using quasi-elastic neutron scattering (QENS) technique. Results show that a higher fraction of hydrogen is mobile within the nanoconfined systems relative to bulk $TiCl_3$-doped $NaAlH_4$. However, the overall motion of hydrogen was localized and the nanostructured Ti-doped $NaAlH_4$ exhibited mobility than the bulk (not nanostructured) materials of the same composition. Data were collected on both a time of flight spectrometer (Disc Chopper Spectrometer or DSC) and a backscattering instrument (High Flux Backscattering Spectrometer or HFBS). Around 65% to 75% of all available hydrogen atoms are mobile at 400K while participating in short-range dynamics. However, less than 10% hydrogen was mobile at higher temperatures of 420K and 450K, possibly because the higher temperatures lead the formation of phases which tightly bind the hydrogen within the lattice. The quasi-elastic signal from bulk (not nanostructured) Ti-doped $NaAlH_4$ shows lattice diffusion type behavior. Around 15% of hydrogen participate in motion at 400K (relative to 2.5% mobile hydrogen in bulk Ti-doped $NaAlH_4$ at 450K). The nanostructured samples demonstrated jump lengths of 2.78 Å, which compares well with bulk Ti-doped $NaAlH_4$ jump lengths of 2.6 Å. Differential scanning calorimetry data indicates that desorption from the nanoconfined Ti-doped $NaAlH_4$ occurs at ~100^{o}C (in agreement with other reports for nanostructured hydrides). This talk will review the benefits of using QENS to address hydrogen mobility.

BIOGRAPHY

Tabbetha Dobbins is a Professor in the Dept. of Physics & Astronomy and Interim Vice President for Research and Dean of the Graduate School at Rowan University. Her degrees are: B.S. in Physics from Lincoln University (PA); M.S. in Materials Science and Engineering at the University of Pennsylvania; and Ph.D. in Materials Science and Engineering from Penn State University. As an NRC Post-doctoral Fellow at NIST, she first began synchrotron X-ray and neutron characterization. She has mentored students in both graduate and undergraduate research projects and engages in broadening the participation of students in synchrotron x-ray and neutron studies at national research laboratories. Her research programs are aimed at attracting top students to the sciences using societally relevant energy-related and biomedical-related topics. She continues to do cutting edge research in applying synchrotron x-ray and neutron analysis to modern engineering problems in carbon nanotubes, gold nanoparticles, the hydrogen fuel economy, and polymer self-assembly. Also, she has worked diligently to engage high school students in science through her NSF funded programs. She currently serves on the executive steering committees for the African Light Source Foundation and the LAAAMP project. She was also a member of the on the Institute of Physics - Task Force for Underrepresentation of African Americans in Physics.