Departments of Physics Colloquium

Materials under Extreme Conditions

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(Center for the Study of Matter under Extreme Conditions), FIU

1:30 – 2:30 PM Friday, September 23, 2016

Venue: RB 130, MMC

Abstract: Water turns into ice when temperature drops below the freezing point, do you know that water can become ice even at room temperature? Materials under high pressure and temperature have rich physics and chemistry. As two fundamental variables in tuning materials properties, pressure and temperature have significant impacts on material science. This talk will highlight some recent researches of materials properties using the state-of-the-art high pressure facilities at synchrotron light sources (APS, and NSLS). In the past decade, nanomaterials have shown tremendous impacts on science and technology. When approaching nano-scale sizes, materials may show characters significantly different from bulk substance. Along this direction, the talk will present evidence of strength enhancement by nano crystals in MgO using in-situ x-ray diffraction at high pressures, synthesis and characterization of superhard boron suboxide (B_6O) and its nano-composite. A story from the strength measurements at high pressure favorable to geophysicists is the study of stress storing capabilities of mantle minerals at high pressures. Collective results on mantle dominant minerals: olivine, wadsleyite, ringwoodite, garnet and perovskite offer a tale unveiling the puzzle of deep earthquakes distribution with depth along the subduction slab. This talk will also present a study on the high pressure phase of boron, in which ionic bonding is found between atoms of the same element, and therefore this new phase formed under high pressure and high temperature (above 120,000 atmosphere and 1400 Celsius) can be considered as boron boride. Some of these results have been published in *Nature* (2002, 2009) and *Science* (2016). High pressure research is a very promising field for material science. As pressure and temperature influence thermodynamic equilibrium in opposite ways, a possible direction of future research is to revise the temperature-induced hydrogen release − rehydrogenation of hydrogen storage material as a green energy carrier.

Biography: Dr. Jiuhua George Chen is a Professor in the Department of Mechanical and Materials Engineering and the Director of Center for the Study of Matter under Extreme Conditions at FIU. He receives his PhD of synchrotron radiation from Japan Graduate University for Advanced Studies and is one of the pioneers in application of synchrotron x-rays to high pressure research. Before joining FIU, he was an Associate Director of Minerals Physics Institute and Associate Dean at Stony Brook University. He received FIU Faculty Awards for Excellence in Research and Creative Activities (2012) and in Advising and Mentorship (2015).

The event is free and open to the public.

Future seminars can be found at http://physics.fiu.edu/seminars/