MSE SEMINAR
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113 McBryde Hall
3:30 – 4:30 PM
Refreshments at 3:00

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Abstract
A solid oxide fuel cell (SOFC) is a highly efficient device which can electrochemically convert the chemical energy of various fuels to electricity and heat with little pollution. SOFCs can be used as power supply to factories, power stations, and have promising applications for hydrogen based vehicles and portable electronic devices. However, the high operation temperature (~1000 °C) of conventional SOFCs would lead to various problems such as high energy loss, materials instability, degradation, sealing issues and high cost of cell materials. In the past decades, lots of efforts have been devoted to lowering the operation temperature, resulting in the fast development of intermediate temperature SOFCs (IT-SOFCs). Two efficient methods have thereby been established: one is to search alternative materials with high ionic conductivity working at low temperature (~500 °C or even lower) and another is to decrease the thickness of electrolyte. Rare-earth doped ceria has been considered as the promising candidate as the electrolyte material for IT-SOFCs. Nevertheless, the key issue for doped ceria is the non-monotonic behavior of conductivity as a function of doping level. By the systematic study of microstructures of doped ceria, we elucidate the relationship between the ionic conductivity and dopant concentration. For the first time, the structural phase transformation from F-type to C-type structure has been interpreted by the defect cluster model, which may also be considered as a universal model for other oxygen deficient oxides. Moreover, this simple model can help us to illustrate the degradation phenomenon in IT-SOFCs. On the other hand, the electrolyte-electrode interfaces of thin film IT-SOFC have also been comprehensively studied. A new interfacial layers arising from mutual diffusion have been detected and proved to be detrimental for IT-SOFC performance. More important, it was clarified that such interfacial layers would be formed even before cell operation, which draws our attention to prepare high quality electrolyte-electrode interfaces for IT-SOFC applications.

Bio Sketch
Dr. Li currently works at the National Institute of Standards and Technology (NIST) as a guest researcher performing materials characterization by electron microscopy with specialization in TEM, STEM, HRTEM and Energy Filtered TEM. Prior to joining NIST he was a Research Associate and UNC-Chapel Hill from 2011-2012, and prior to UNC he was a researcher at Japan's National Institute for Materials Science, where he also excelled in the development of structure property relationships via various electron microscopy techniques. While in Japan, the major Tsunami occurred in 2011, which brought him to UNC-Chapel Hill. Dr. Li holds a PhD in Physics from the National University of Singapore and a BS in Physics from Beijing Normal University (China). Li is the author/co-author of more than 30 publications, also acted as reviewers for more than 30 international journals and has received many honors for his work over the past 10 years.