Dr. Thomas O. Mason

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"Defect Chemistry and Properties of Transparent Conducting Oxides"

University of Missouri-Rolla Ceramic Engineering Seminar Series Speaker
Thursday February 19th, 2004

McNutt Hall, Room 204
3:30pm

Biography:
Dr. Mason graduated from Penn State University with a BS in Ceramic Science. He received his PhD in Materials Science and Engineering from the Massachusetts Institute of Technology. Dr. Mason is a member of the Academy of Ceramics and a Fellow of the American Ceramic Society, from which he received the Schwartzwalder-PACE and Fulrath-Pacific Awards. He has ~220 technical publications and was named a "highly cited author" by the Institute for Scientific Information. Dr. Mason is currently one of several Charles Deering McComick Professors of Teaching Excellence at Northwestern University.

Abstract:
Transparent conducting oxides (TCOs), which are enabling components of low-emissivity windows, flat panel displays, solar cells, organic light-emitting diodes, and other electro-optical devices, have been known for almost a century now, and commercially utilized for decades. However, only within the last two decades have we begun to understand the point defect structure-property relationships of doped single-oxide TCOs such as ZnO, In_2O_3 and SnO_2. During the 1990s, multi-cation (compound and solid solution) TCOs based upon CdO, ZnO, In_2O_3, SnO_2 and Ga_2O_3 began to be discovered and developed at a rapid pace. Until recently, all TCOs were n-type in character. This changed with the discovery of Cu-based p-type TCOs in Japan, thereby opening up the possibility for all-oxide/transparent electronics. Even more recently, UV-activated and persistent n-type transparent conductivity has been achieved in a calcium aluminate ceramic doped with hydrogen, with the potential for UV-writeable wires and devices. In this talk, we consider the emerging families of TCOs, their crystal chemistries, doping mechanisms, electronic structures, and transport properties. Bulk studies are instructive, however significantly enhanced doping levels can be achieved in thin film TCOs, with important technological ramifications. We also consider TCO "figures of merit," and the factors governing the optimization of transparency vs. conductivity, with special attention to the factors limiting carrier mobility.

A meeting of the UMR Chapter of the American Ceramic Society and the Missouri Chapter of Keramos will follow the Seminar in McNutt 211.

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