USC Viterbi School of Engineering

MORK FAMILY DEPARTMENT OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE

Distinguished Lecture Series

Presents

Understanding Interfacial "Phase" Behaviors to Help Decipher the Materials Genome

Professor Jian Luo

University of California, San Diego

Abstract

A piece of ice melts at 0 °C, but a nanometer-thick surface layer of the ice can melt at tens of degrees below zero. This phenomenon of stabilization of nanoscale liquid-like interfacial "phases" below the normal bulk melting temperatures, known as "premelting," was first recognized by the physicist Michael Faraday in 1842. Since then, materials scientists have discovered that the surfaces and interfaces in engineered materials can exhibit more complex phase-like behaviors at high temperatures, which can affect the fabrication and properties of a broad range of metallic alloys and ceramic materials. Specifically, recent studies of 2-D grain-boundary interfacial phases (also called "complexions") shed light on several outstanding scientific problems that have been puzzled the materials science community for decades, including the origins and atomic-level mechanisms of activated sintering, liquid metal embrittlement, and abnormal grain growth. Analogous surface phenomena have also been studied and utilized to improve the performance of batteries, supercapacitors, photocatalysts and oxygen-ion conductors. Since bulk phase diagrams are one of the most useful tools for materials design, it is conceived that interfacial "phase" diagrams can be developed as a useful materials science tool.

Bio: Jian Luo graduated from Tsinghua University in 1994 with dual Bachelor's degrees, one in Materials Science and Engineering and another in Electronics and Computer Technology. He received a M.S. degree in Materials Science and Engineering in 1999, and a Ph.D. degree in Ceramics in 2001, both from M.I.T. Luo worked in the industry for more than two years with Lucent Technologies and OFS/Fitel from 2001 to 2003, before he joined the Clemson faculty, where he served as an Assistant/Associate/Full Professor of Materials Science and Engineering from 2003 to 2012. In January 2013, he joined UCSD as a Professor of NanoEngineering and Materials Science and Engineering. Luo received a National Science Foundation CAREER award (from the ceramics program) in 2005 and an Air Force Office of Scientific Research Young Investigator award (from the metallic materials program) in 2007. He was named as a National Security Science and Engineering Faculty Fellow (NSSEFF) by the U.S. Department of Defense in 2014.

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12:45 pm, ZHS Room 159

The scientific community is cordially invited.