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HKIAS Distinguished Tutorial Series in Materials Science

Grain Boundary Structure and Dynamics: a tutorial

Professor David J Srolovitz

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Senior Fellow, Hong Kong Institute for Advanced Study, City University of Hong Kong

Lecture 1 Grain boundary basics, dislocations, steps, crystallography, structural units
Lecture 2 Grain boundary energy, metastability, defects
Lecture 3 Grain boundary dynamics
Lecture 4 Grain boundaries in polycrystals - microstructure, plasticity, point defects

Due to concerns about the coronavirus outbreak, there will be no registration and on-site audience for the event. Video and PowerPoint of the lecture will be posted on the HKIAS website at www.hkias.cityu.edu.hk on ***19 June 2020 (Friday).***

Abstract

The most widely used engineering materials are polycrystalline (ensembles of crystallites of differing orientation). Grain boundaries (interfaces across which crystal orientation changes) are the pre-eminent defects in polycrystalline materials. While grain boundaries have been widely studied for nearly a century, our understanding of these important defects has grown by leaps and bounds in recent years. In these lectures, I will attempt to synthesise thermodynamic, crystallographic, statistical mechanics and kinetic descriptions of grain boundary structure and behaviour. The goal of these tutorial lectures is the development of a predictive, coherent understanding of grain boundary structure, energetics, and motion from the atomistic to continuum scales.

Please note that the selection of topics in this tutorial is based on my personal interests and are not intended to be (1) a survey of grain boundary phenomena or (2) a review the breadth of interesting research within the field. Of particular importance is its omission of any discussion on alloying effects (a good topic for another tutorial!).

This series of tutorial lectures is designed for students who are new to the field of grain boundary/interface research, the non-specialist materials scientist seeking an update of recent developments, and specialists in the field interested in a holistic approach to the subject. The pre-requisites for this lecture are a rudimentary understanding of elasticity, statistical mechanics, crystallography, and crystal defect.

Biography

David Srolovitz did a PhD in Materials Science at the University of Pennsylvania and a post-doc at the Exxon Corporate Research Laboratory, followed by a staff position in the Theory Division of Los Alamos National Laboratory. He was a professor of Materials Science & Engineering and of Applied Physics at the University of Michigan, professor of Mechanical & Aerospace Engineering, Materials Science, and Applied Mathematics at Princeton University, professor of Physics at Yeshiva University, and professor of Materials Science & Engineering, Mechanical Engineering & Applied Mechanics, and Computer & Information Science at the University of Pennsylvania. He was the Executive Director of the Institute of High Performance Computing (Singapore) and served variously as a department chair and dean. Amongst his many awards is membership of the US National Academy of Engineering, Fellow of MRS, TMS, ASM, and Institute of Physics and is the winner of the MRS Materials Theory Award. He joined the City University of Hong Kong and the Hong Kong Institute for Advanced Study in 2018.