



The Hebrew University Center
for Nanoscience & Nanotechnology



Nano Seminar

Interfacial Complexions & Thermodynamic Transitions at Interfaces

Prof. Wayne D. Kaplan

*Department of Materials Science and Engineering
Technion - Israel Institute of Technology, Haifa 32000, Israel*

Abstract:

Since the 1980s it has been recognized that the structure of grain boundaries in polycrystalline ceramics can have a diffuse nature, characterized by a $\sim 1\text{nm}$ thick nominally amorphous film. More recently, the structure of grain boundaries has been described following diffuse interface theory, stating that the structure and chemistry of grain boundaries, interfaces and surfaces can go through two dimensional transitions between thermodynamic states (sometimes termed *complexions*). As an example, surface reconstruction is a first order complexion transition, equivalent to a discontinuous change in the level of adsorbed excess. As such complexions for interfaces are analogous to phases in bulk, although they are not bulk phases. In the past these conclusions have been reached based on structural characterization of grain boundaries and interfaces correlated with mechanical and electrical properties, and more recently it has been shown that specific complexions can have a significant influence on grain boundary mobility, and thus the morphology of an evolving microstructure.

To date, almost all of these studies have been conducted at grain boundaries in single phase polycrystalline systems, which by definition are not at equilibrium, and in some cases it is not even clear if the identified complexions are at steady-state. Similar questions have been raised for studies focusing on metal-ceramic interfaces from thin film studies, where the deposition process used to form the samples may be very far from equilibrium.

This presentation will focus on an experimental approach to address the structure, chemistry and energy of complexions at (metal-ceramic) interfaces which are fully equilibrated, from which it can be demonstrated that formation of a complexion at equilibrium minimizes interface energy. This will be compared with complexions at solid-liquid interfaces, where a region of ordered liquid exists adjacent to the interface at equilibrium, and the details of a reconstructed solid-solid interface where the reconstructed interface structure accommodates lattice mismatch for a nominally incoherent interface. These three systems will be compared to known reconstructed solid surfaces, which can also be described as complexions, within a more generalized Gibbs adsorption isotherm.

Gathering & Refreshments at 10:50

Please contact Alexandra Bannykh at 6584919 if you are interested in meeting the lecturer.

Tuesday, June 20th 2017, 11:00 at the Seminar Hall
Los Angeles Building, entrance floor.