It is recognized that grain boundaries (GBs) can adopt a diffuse structural nature, and be described using diffuse interface theory, where the structure and chemistry of GBs, interfaces and surfaces can go through 2-D transitions between thermodynamic states (termed complexions) in order to minimize the interface energy [1-2]. As such, complexions for interfaces are analogous to phases in the bulk.

To date, almost all of these studies have been conducted at GBs 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 [3-4]. Similar questions have been raised regarding interfaces in thin film studies, where the deposition process 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 a change in complexion reduces interface energy [5-6]. This will be compared with complexions at solid-liquid interfaces, where a region of ordered liquid exists adjacent to the interface at equilibrium [7-10], and the details of a reconstructed solid-solid interface where the reconstructed interface structure accommodates lattice mismatch for a nominally incoherent interface [11]. 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.

References