CS5: Contributed Session V

Modeling of Ischemia Reperfusion and Postconditioning

Daniel Fong, *U.S. Merchant Marine Academy*

Reperfusion (restoration of blood flow) after a period of ischemia (interruption of blood flow) can paradoxically place tissues at risk of further injury. Recent studies have shown that postconditioning (intermittent periods of occlusion applied during reperfusion) can reduce ischemia reperfusion injury. In this talk, we will present a mathematical model to describe the reperfusion and postconditioning process following an ischemic insult, treating the blood vessel as a two-dimensional channel lined with a monolayer of endothelial cells. This model is used to investigate how postconditioning affect the cell density, by varying the frequency of the pulsatile flow and the oxygen fluctuation at the inflowing boundary. This is a joint work with Linda Cummings (NJIT).

On the Coffee Stain Problem

Emre Esenturk, *University of Warwick*

The transport of solute in an evaporating droplet is a pivotal problem in additive manufacturing industry. Current theories predict complete transfer of all solute to the edge, known as the coffee stain effect. Experimentally, this is not quite the case since some solute accumulates in the interior. We present some results on the new modified model. The simplified physics is described by a system of coupled transport equations. Analysis of these equations will be discussed.

Mathematical Model of Electromigration-Driven Evolution of the Surface Morphology and Composition for a Bi-Component Solid Film

Mikhail Khenner, *Western Kentucky University*

A two PDEs-based model is developed for studies of a morphological and compositional evolution of a thermodynamically stable alloy surface in a strong electric field, assuming different and anisotropic diffusional mobilities of the two atomic components. The linear stability analysis of a planar surface and the computations (using the Method of Lines) of morphology coarsening are performed. It is shown that the conditions for instability and the characteristic wavelength and growth rate differ from their counterparts in a single-component film. Computational parametric analyses reveal the sensitivity of the scaling exponents to the electric field strength and to the magnitude of anisotropies difference.

Step-Flow Stability in the Presence of Electromigration During Evaporation

Nick Kirby, *Austin Peay State University*

A step-flow model of crystal growth is thermodynamically consistent if all of its motions are automatically consistent with the second law of thermodynamics. Such a thermodynamically consistent model for crystal growth is presented in which there is a drift velocity arising from the interaction between an electric current and atoms on a crystal surface (this interaction is called electromigration). A stability analysis is performed and discussed.