SINAM NANO SEMINAR

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Nano Manufacturing (SINAM) presents

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Self-Organization of Nanostructured Metal Filament Array by Electrochemical Deposition

Prof. Mu Wang, Nanjing University

Tuesday, March 21, 2006
4:00 - 5:00 pm
3110 Etcheverry Hall

(Refreshments provided)

Abstract

The metal deposits generated by electrochemical deposition usually have a ramified morphology, which is often ascribed to diffusive noise in the interfacial growth. In addition to random diffusive noise, convection (both natural convection and electroconvection) and electric migration also affect the morphology of the electrodeposits significantly. We once demonstrated that when electroconvection becomes sufficiently strong, neighboring deposit branches may approach each other, eventually form a network pattern. To suppress convection, thin cells and agarous gel are conventionally used. However, in these cases, very often some uncontrollable interfacial chemical factors are introduced, which make the situation even more completed. We designed a unique electrodeposition system to solve the above problem, which consists of an ultrathin electrolyte layer. In this system the metal electrodeposits (copper, cobalt, zinc and silver) are shiny, finger-like on macroscopic scale and grow robustly on the glass substrate. Microscopically, scanning electron microscopy shows that the fingering branch consists of filaments with periodic nanostructures. The filaments have considerably low branching rate. In the experiments we used either potentiostatic or galvanostatic designs. Similar deposit morphologies were generated in both scenarios. In the potentiostatic mode (the voltage across the electrodes keeps constant), we found that the electric current in the system is spontaneously oscillating; whereas for galvanostatic mode (the current keeps constant), the voltage across the electrodes oscillates spontaneously. In this talk I am going to discuss following questions (1) What is the mechanism for the formation of the periodic nanostructures on the filaments? What does the periodic structure on the filaments correspond to? (2) How the periodicity of these spatio-temporal structures depend on the experimental conditions? (3) What are the physical properties of an individual filament with the periodic chemical modulation?

About Prof. Wang

Prof. Mu Wang is a Cheung-Kong Professor of Condensed Matter Physics, Professor of Physics, and serves as Deputy Director, National Laboratory of Solid State Microstructures, at Nanjing University. Prof. Wang has been working on self-organized interfacial growth and spatiotemporal oscillations in crystallization since 1986.

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