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Directing Self-Assembly of Heterogeneous NanoSystems

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Thursday, Dec 5, 2013, 3PM

RLE Haus Conference Room: 36-428

Abstract: Directed self-assembly of block copolymers is a route to obtain tailored 2D patterns on the 10nm scale that have a high degree of order. These patterns are promising for applications in multiple areas, including sub 10nm lithography, light harvesting, and organic electronics. In this talk I will present our work on directed self-assembly of diblock copolymers templated by graphoepitaxial methods. In particular, I will show a new technique that we have pioneered for performing inverse self-assembly in which the input is a given target pattern and the algorithm provides an optimal template solutions for such pattern. Experimental results confirming the predictions will be also presented. Afterwards, I will also discuss about how one can then "dope" the system with other materials as could be nanoparticles and organic components and realize well ordered functional heterogeneous systems. At the end I will present some future challenges and perspectives in this area.

Bio **Alfredo Alexander-Katz** is the Walter Henry Gale Associate Professor of Materials Science and Engineering at MIT. He received his B.S. in Physics from the National Autonomous University of Mexico (UNAM) in 1998 and his Ph.D. in Physics from the University of California at Santa Barbara in 2004. His thesis focused on understanding the self-assembly of copolymers using novel field-theoretical methods. As an NSF International Postdoctoral Fellow, he studied the dynamics of driven polymers that led to an important discovery unraveling the mystery behind the process of blood clotting at high shear rates. This opened new routes for the development of novel shear responsive materials. As a CNRS postdoctoral researcher at Ecole Superieure de Physique et Chimie Industrielle (Paris, France), he studied charged polymer solutions and their self-assembly with direct applications to fuel cells. His current interests lie in the realm of self-assembly and dynamics of biological soft-materials using a combination of analytical theory and simulations. His group is particularly focused in designing novel polymer-like drug delivery carriers and understanding their response to chemical and physical stimuli. They are also working on understanding the supramolecular self-assembly of chlorophyls in the antennas of Photosynthetic Bacteria which are the most efficient light harvesting organisms on Earth, as well as studying the dynamics of driven soft systems in general. This researchis highly interdisciplinary, and lies at the interface of materials, biology, physics, chemistry and medicine.

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The Center for Excitonics is an Energy Frontier Research Center funded by the U.S. Department of Energy, Office of Science and Office of Basic Energy Sciences