Soft Matter World Newsletter

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Dear Soft Matter Colleagues,

Welcome to our newsletter. This month we are featuring the Azzaroni Laboratory from Universidad Nacional de la Plata in Buenos Aires, Argentina, a study on electrically conductive polymeric photonic crystals, and a model of bulk molecular structure in an amorphous metal. Summer and autumn conferences are approaching; register for some of these exciting events. Have a pleasant read and a warm June.

Soft Matter Laboratory INIFTA Universidad Nacional de la Plata

Dr. Omar Azzaroni has a unique research platform partnering Argentina with Max Planck in Germany. The soft matter research group at Universidad Nacional de la Plata in the beautiful city of Buenos Aires, Argentina is a partner group to the Max-Planck-Institute für Polymerforschung in Mainz, Germany and is part of the Argentinian research consortium Centro Interdisciplinario de Nanociencia y Nanotecnología. The consortium currently provides PhD research opportunities for projects based on "soft nanotechnology". The laboratory at INIFTA focuses on nanostructures in soft matter systems.

Some of their research directions are:

- Polymer Brushes – Nanostructured Macromolecular Surfaces for "Smart" Surfaces and Colloids: These customizable molecules are nanoscale, ordered, short polymers tethered at one end to a surface to form nano-sized polymer brushes. Different surface properties are induced in these systems by transitions in the polymer brush between stretched and collapsed states. Such highly customizable surfaces provide an interface for the investigation of the fundamentals of self-assembly and sedimentation. Polymer brushes are also used as building blocks for responsive surfaces and colloidal assemblies.

- Macromolecular Assemblies in Nano-confined Geometries and Hierarchical Nanomaterials: In all living systems, biological channels work as nanodevices in charge of regulating key functions. Ionic circuits capable of sensing, switching, or separating diverse species in aqueous solutions are synthesized through layer-by-layer assembly of polyelectrolytes into ionic current rectifying solid-state nanopores.

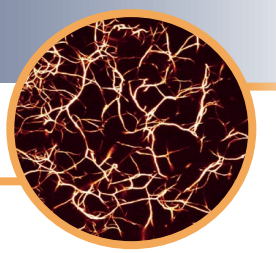
▲ Scanning electon microscopy images of self assembled nano-tubes using track-etched nanomembranes (left and middle) and a hybrid silicon proton conducting membrane (right)

- Electron Transfer in Supramolecular Bioconjugates and Complex Functional Biointerfaces: Tethering enzymes that catalyze redox reactions, such as glucose oxidase, to an electrode is a method to incorporate redox functionalities into surfaces. The control of supramolecular properties of immobilized molecules at the monolayer level enables the manipulation of the conductive states of the assemblies and the generation of electronic signals due to the electron transfer between molecules in solution and the electrode.

- Self-Organization of Unimolecular Micelles – Supramolecular Nanocontainers: Using hyperbranched amphiphilic polymers prepared in a one step process, the group explores the structural and physicochemical properties of hyperbranched unimolecular micelles in solution and designs self-organized organic nanostructures with unprecedented functional features.

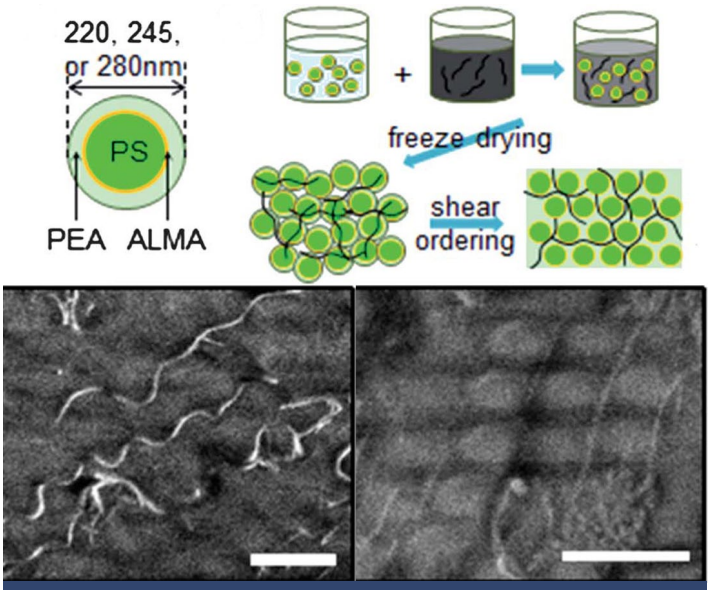
The highly interdisciplinary research this group conducts is reflected by their international list of collaborators that encompasses Europe and South America.

Read more on their website.



Electrically Conductive Polymeric Photonic Crystals

Y. Imai, C. E. Finlayson, P. Goldberg-Oppenheimer, Q. Zhao,P. Spahn, D. R. E. Snoswell, A. I. Haines, G. P. Hellmannb, and J. J. Baumberg. Soft Matter, Vol. 8, pp. 6280-6290. DOI: 10.1039/c2sm06740d



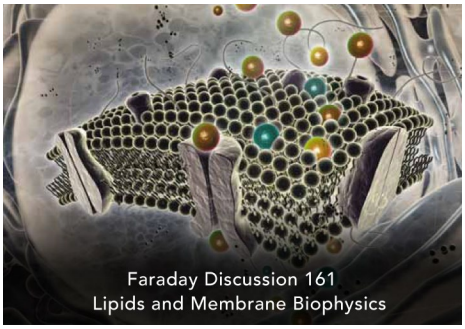
▲ Schematic of the preparation procedure of SWNT- doped polymer opals (top). SEM images before (left) and after annealing (right) of a green opal film with 1%wt SWNT.

Electrically conductive polymeric photonic crystals are an emerging, fascinating class of materials that may see applications across a broad range of industries due to their plasticity and highly tunable optical and electrical properties. Researchers from the University of Cambridge and the Deutsches Kunststoff-Institut synthesized novel polymeric conductive photonic crystals consisting of single-walled carbon nanotubes (SWNT) and monodisperse core-shell polymer spheres through shear ordering and controlled annealing. Optical and electrical properties of the crystals before and after annealing were recorded through stress-strain measurements as well as transmission and scanning electron microscopy.

Annealing the polymer for one hour was found to increase electroconductivity by up to three orders of magnitude. Annealing stabilized the nanotubes due to reduction of surfactant and had no effect on the configuration of the polymer sphere lattice. The longer the sample was annealed, the further the non-conductive to conductive behavior cut off frequency shifted towards a lower wavelength. The concentration of nanotubes rather than the annealing process had an effect on the optical properties of the polymer. Strong absorption by the nanotubes reduced reflection peak amplitudes and the peaks also showed a red-shift with increasing nanotube concentration. This demonstrates that the assembly of single walled carbon nanotubes can successfully proceed into heterogeneous polymer composites through solution assembly and any required processing, followed by local strain relaxation and electrical reconnection through controlled annealing.

The advanced functionality of combining electronic and opto-electronic activity has many attractive properties that may lead to diverse applications such as LEDs and electrically pumped photonic crystal-feedback lasers (with inherent stretch tunability), electrochromic filters, optical sensors exploiting electrostriction effects, or as components in light-harvesting and solar cell devices.

Read more in Soft Matter.

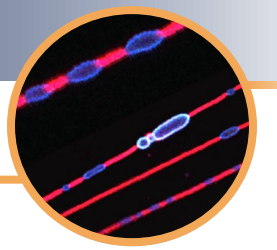


Faraday Discussions Presents:

Lipids and Membrane Physics

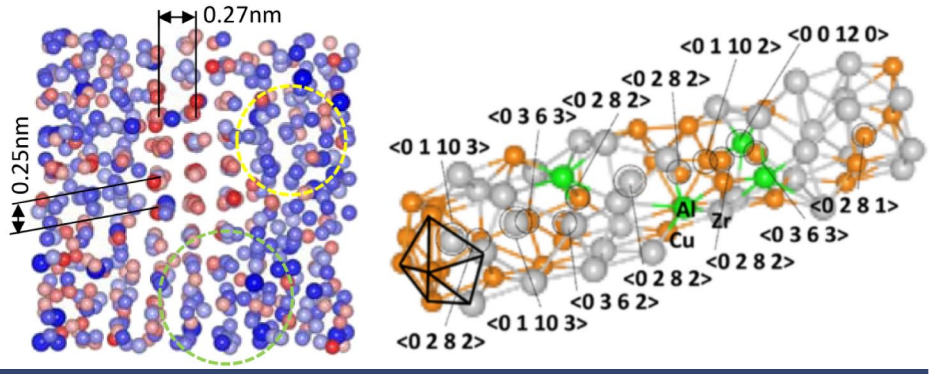
This Faraday Discussion will consider recent developments in the study of biomembrane structure, ordering and dynamics, with particular emphasis on the roles of lipids in these phenomena. There will be four sessions with four to five talks per session. Early bird registration ends June 13th and regular registration ends August 10th.

Register online.



Nanoscale Structure and Structural Relaxation in $Zr_{50}Cu_{45}Al_5$ Bulk Metallic Glass

Jinwoo Hwang, Z. H. Melgarejo, Y. E. Kalay, I. Kalay, M. J. Kramer, D. S. Stone, and P. M. Voyles. Physical Review Letters 108, 195505 (2012). DOI: 10.1103/PhysRevLett.108.195505



▲ A region of the metallic glass that includes the crystal-like supercluster. A chain icosahedral supercluster from the yellow circled region.

Researchers from the University of Wisconsin, Madison and the Ames Lab in Iowa have significantly elaborated on existing models for bulk metallic glass structure by incorporating fluctuation electron microscopy data into a hybrid reverse Monte Carlo simulation. Metallic glasses, otherwise called amorphous metals, are unique substances because of their highly disordered amorphous structure with short-range order and conductive properties. A deeper knowledge of their structure may lead to creating less fragile, more versatile metallic glasses.

The researchers found superclusters of atoms in crystal-like local environments, and chain superclusters of icosahedral-like Voronoi polyhedra. An interesting result from his model is that a large proportion of the amorphous glass consists of crystal like local clusters of different kinds. This paper was featured in a Physical Review Focus, where you can get contextual information about the experiment and metallic glasses.

Read the original article in PRL.

MRS Fall Meeting

The 2012 MRS fall meeting will be held on November 25 – 30 at Hynes Convention Center in Boston, Massachusetts. It will host 53 technical symposia grouped into six broad technical clusters including: materials for energy technologies, soft materials and biomaterials, functional materials and nanomaterials, structural and advanced materials, synthesis, and characterization and modeling methods. The deadline for abstract submission is June 19th.

Register online.

We hope you enjoy browsing softmatterworld.org and come back soon

Linda S. Hirst, Adam Ossowski and Dmitri Medvedko

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