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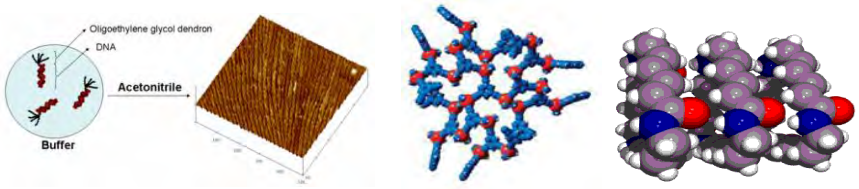


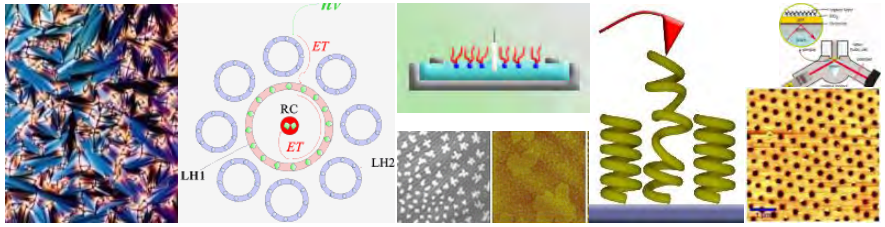
Hosted by/Tenu à:
Université de Montréal

CSACS CRMAA

2010
STUDENT SYMPOSIUM
COLLOQUE ÉTUDIANT

14 Sept. 2010

Pavilion J.-Armand Bombardier



CSACS CRMAA

Student symposium

Colloque Étudiant

2010

Special thanks to/Remerciements:

CSACS Coordinator: Petr Fiurasek

CSACS Student Committee:
Gwenaelle Bazin (U de M)
Olga Borozenko (U de M)
Stephane Dufresne (U de M)
Andrea Greschner (McGill)
Zahid Mahimwalla (McGill)
Iryna Perepichka (U de M)
Georgios Rizis (McGill)
Rolf Schmidt (Concordia)

If anyone is interested in being a part of the student committee or helping to organize this event next year, please email Petr at *csacs.chemistry@mcgill.ca* or talk to one of the people thanked above.
Les personnes intéressées à participer au comité étudiant ou à l'organisation de cet événement l'an prochain sont invitées à communiquer par courriel au *csacs.chemistry@mcgill.ca* ou à parler avec une des personnes remerciées ci-dessus.

Schedule / Horaire

9:30	Registration, refreshments, and poster setup Inscription, rafraichîssements, et installation des affiches
10:00	Welcoming remarks/Discours d'ouverture
10:10	**Eric Dionne** (UQAM)
10:30	**Jonathan Hiltz** (McGill University)
10:50	**Xin Wang** (Université de Montréal)
11:10	Mini Break/pause
11:20	**Andrea Greschner** (McGill University)
11:40	**Yuping Zhang** (McGill University)
12:00	Lunch and Poster session/session d'affichage
13:15	*Invited speaker/conférencière invitée:* **Annik Brosseau**, FQRNT, overview of the different scholarship programs
14:00	**Olivier R. Bolduc** (Université de Montréal)
14:20	**Bin Huang** (McGill University)
14:40	Coffee break/pause cafe
15:10	**Amine Fourati** (Université de Montréal)
15:30	**Blythe Fortier-McGill** (McGill University)
15:50	Closing remarks/mots de clôture
16:30	Reception/Vote for best talk and poster Réception et vote pour la meilleure présentation et affiche
16:45	Announcement of Winners/ annonce des gagnants
18:00	Adjourn/ajourner

Jonathon Hiltz (McGill University)

Nanoplasmonic phytoliths

Diatoms are siliceous micro-organisms (phytoliths) exhibiting nano- to micro-scale SiO_2 frustule patterning. There is rising interest in exploring the use of mineralized bio-structures for catalysis, immunoassay, electronic, magnetic and optical field response. This talk will present findings related to the decoration of *Nitzschia Closterium* and *Coscinodiscus Wailesii* with Ag nanoparticles. Binding of the nanoparticles and small molecules to the diatoms is monitored by confocal surface enhanced Raman microspectroscopy. We compare the spectroscopic response with that from Ag nanoparticles bound to the surface of glass that can act simultaneously as a multimode optical waveguide.

Eric Dionne (UQAM)

Electrochemical study of binary ferrocene alkylthiol SAMs containing different surface concentrations and phase states of ferrocene

The detection and quantification of molecules or biomolecules present in trace levels in a complex matrix constitute an important challenge in (bio-)analytical chemistry. Recent advances in microfabrication are providing the sensitivity to overcome this challenge. Microcantilevers, are potentially good candidates for the label-free in-situ detection of biomolecules and biomolecular interactions. Briefly, microcantilever sensors work as follows: the microcantilever is modified with an active self-assembled monolayer (SAM). Binding of the analyte to the active groups in the monolayer induces intermolecular changes that result in a change in surface stress and a vertical deflection of the cantilever. The magnitude of the deflection depends on the analyte concentration. Detection limits as low as ppt (10-12 level) have been reported. [1] Recently, the origin of the surface stress changes that arise during the electrochemical oxidation of ferrocenylalkanethiolate-modified microcantilevers was investigated. [2] It was found that the cantilever bending results from collective in-plane molecular interactions within the SAM and not from individual phenomena[2]. This finding has important consequences for employing SAM-functionalized cantilever microdevices for quantification in (bio)analytical chemistry.

We extend our previous study to investigating the effects of ferrocene dispersion and coverage on the amplitude of the microcantilever deflection. This talk presents the results obtained for binary SAMs containing different surface concentrations and phase states (*i.e.*, aggregated *vs.* isolated) of ferrocene.

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[1] Carrascosa, L.G.; Moreno, M.; Alvarez, M.; Lechuga, L.M., Trends Anal. Chem. 2006, 25, 196-206.
[2] Norman, L., Badia, A., J. Am. Chem. Soc., 2009, 131, 2328

Blythe Fortier-McGill (McGill University)

^{1}H and ^{13}C MAS NMR study of the hydrogen bond network of PMAA complexes and multilayers

The static and dynamic properties of the hydrogen bond networks of poly(methacrylic acid) (PMAA) complexed with poly(ethylene oxide) (PEO) and poly (vinyl methyl ether) (PVME) were characterized by high resolution ^{1}H and ^{13}C MAS NMR techniques. Complexes with other hydrogen bond accepting polymers were also examined: polyacrylamide (PAAM), polyvinyl pyrrolidone (PVPon) and polycaprolactam (PVCL). In the case of the weaker PMAA complexes, the ^{1}H DQ MAS and ^{1}H-^{13}C HETCOR NMR spectra of the dried bulk complexes showed the presence of intra-polymer hydrogen bonds assigned to two types of carboxylic acid dimers related to the tacticity of PMAA in addition to the resonances assigned to the interpolymer hydrogen bonds of the complexes. The ^{13}C chemical shifts of the carboxylic groups of PMAA allowed a quantitative comparison of the intra- and interpolymer hydrogen bonds of the PMAA-PEO and PMAA-PVME bulk complexes and supported multilayers. The 2D ^{13}C NOESY NMR of these two systems showed the presence of slow exchange between the intra- and inter-polymer hydrogen bonds. The effect of water on the populations and exchange rates of the two types hydrogen bonds was examined.

Andrea Greschner (McGill University)

The effect of synthetic molecules on DNA self assembly: Error correction and dramatic changes in assembly products

DNA has emerged as a powerful building block in the bottom-up construction of well-defined 2D and 3D structures. However, yields are often lower than anticipated due to the formation of undesirable side products such as oligomers and partially matched duplexes. Our group has begun to refine DNA assembly methods in order to give higher yields of desired products using two methods: 1) the use of rigid organic vertices to provide pre-organization and guide DNA assembly and 2) employing small molecules that aid in re-equilibrating a mixture of products, to give higher yields of the desired products.

To determine the effect of vertex rigidity, a DNA system has been developed that is purposefully flawed, yielding multiple products. We observed that modifying the rigidity of the vertices in this system results in a dramatic change in the DNA self-assembly process. Moreover, the addition of an external molecule, ruthenium(II) tris-bipyridine allows for 'error-correction' and adds further specificity to the final DNA assembly.

Amine Fourati (Université de Montréal)

Using self-assembly of molecular probes for the detection of time, temperature changes, and deformation of polymers

L'incorporation de molécules aromatiques luminescentes dans les polymères à partir du fondu peut conduire à des informations sur l'orientation des chaînes polymères et sur la conformation du colorant. Dans ce travail, nous avons incorporé le colorant alimentaire fluorescent : 4,4'-bis(2-benzoxazolyl)stilbène (BBS) à deux polyesters: poly(butylène succinate) (PBS) et polylactide (PLA). Les caractéristiques d'émission des films dépendent de la concentration de BBS, de la déformation des polymères et de la température et du temps de recuit. Le ratio d'intensité des pics du spectre de fluorescence du colorant moléculairement dispersé et des excimères explique le changement de couleur réversible entre le bleu et le vert, lié à l'apparition d'une bande intense spécifique à la formation d'agrégats à 500 nm, qui survient pour une concentration de 0,15 %p/p ou plus de BBS ou d'une élévation de la température en fonction du temps de recuit. En effet, le recuit des films trempés entraîne l'auto-assemblage des molécules BBS sous forme d'excimères, accompagné par un changement permanent de couleur du bleu au vert. Cependant, l'étirement du polymère détruit les excimères BBS et conduit à un changement de couleur inverse. De plus, la structure en bâtonnet de BBS favorise l'alignement le long de la direction d'étirement du film PBS, donnant lieu à un ratio dichroique élevé. Par conséquent, le colorant alimentaire BBS peut agir comme une sonde interne de température, de déformation et de temps.

Yuping Zhang (McGill University)

Liquid crystal phase formation in nano cyrstal cellulose suspension: a laser diffraction study

We report on the flow (shear) induced self-assembly ordering of 5 % w/v aqueous chiral nematic phase Nano Crystalline Cellulose (NCC) using 632.8 nm laser diffraction. We observe vertical or circular diffraction depending on sample orientation, which confers different hydrodynamic forces due to gravity on the samples. The pitch of chiral nematic NCC, was also calculated from the first order laser diffraction pattern

Bin Huang (McGill University)

Multilayered polymer nanotubes and their dispersions

This work examines various aspects of polymer nanotube and their dispersions. The polymer nanotubes were prepared by layer-by-layer polymer deposition in porous alumina templates. The resulting nanotubes and the polyelectrolyte stabilized dispersion were characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), viscometry, electrophoresis, etc. Dilute and semi-dilute nanotube dispersions were studied using UV-Vis electro-optics, where the nanotube dispersion was subjected to a high electric field that aligns the nanotubes with the field. From the alignment and relaxation dynamics, we obtained information about the size and shape of the suspended nanotubes in dispersion. The effect of ionic strength, pulse duration, electric field strength, and particle volume fraction were systematically studied. From the nanotube dispersion, uniform thin films denoted as nanopaper were prepared. Their unusual dependence of water vapor permeability on the polyelectrolyte stabilizer was elucidated based on mass transfer and molecular diffusion theories. The nanopaper's mechanical properties were also examined based on paper physics theories. Lastly, latex particles were attached, *via* a bioconjugation reaction, to functionalized nanotubes, and the assembly was fixed by optical tweezers and subject to flow field. In this way, the bending stiffness of individual nanotubes was probed from the induced deflection. The relation between the obtained elastic moduli of multilayered nanotubes, the prediction from the laminated composites model, and the measured bulk property of the nanotubes nanopaper were discussed.

Olivier R. Bolduc (Université de Montréal)

Extending peptide based self-assembled monolayers to drug efficiency screening

The use of peptide based self-assembled monolayers (SAM) allowed the development of a drug efficiency screening technique using surface plasmon resonance (SPR) to follow the inhibition induced by small peptides of the receptor CD36 playing a role in atherosclerosis. There is a great need in the pharmaceutical industry for new drug screening techniques requiring less time, human resources and expertise to investigate more efficiently the clinical potential of new drugs. Professor Huy Ong of University of Montreal demonstrated that small size peptides (~1 kDa) induce a conformational change in CD36 receptor preventing the binding of low-density lipoprotein (LDL) involved in atherosclerosis.

The screening techniques currently used by Professor Ong's lab require days to obtain information for a single peptide. SPR has the potential to greatly reduce the delay needed for those screening therefore reducing the time needed to reach an optimal medication. We already demonstrated the potential of peptide based SAM to realize detection of low nanomolar amounts of analytes directly in crude biological fluids due to their nonfouling proprieties and to their ability to maintain the activity of immobilized proteins. The use of peptide based SAM functionalized with chelating ending allows the attachment of a metal ion able to immobilize the His-tag ending of CD36. This approach offers many advantages amongst: being able to immobilize rapidly any protein often already His-tagged for purification purposes and being easily reversible leading to multiple assays using a single device. This approach was used to obtain similar values of KD than those obtained by using traditional techniques.

Xin Wang (Université de Montréal)

Study on supramolecular, photo-responsive, recyclable elastomers

Study on supramolecular, photo-responsive, recyclable elastomers This talk presents our strategy to construct a supramolecular elastomer that is both recyclable and photoresponsive. Such materials may be promising for applications in light-driven artificial muscles or motors. The product is prepared by ionically complexing a photoactive small molecule such as methyl orange (MO), a commercial sulfonated azo-containing dye, to the quaternized endblocks of poly(dimethylaminoethyl methacrylate)-poly(n-butyl acrylate)-poly(dimethylaminoethyl methacrylate) (PDM-PnBA-PDM) triblock copolymers that we synthesize by atom transfer radical polymerization (ATRP). The middle block has a subambient glass transition (Tg) to confer elastomeric character.

The PDM/MO complex has a Tg of about 180 °C [1], which is suitable for forming physical crosslinks. The first samples made did not show elastomeric character, attributed to too high a proportion of the hard block phase to form isolated PDM/MO spheres in a PnBA matrix, as required for elastomeric character. Simple ways to modify the properties include the addition of low molecular weight substances selective for the PnBA block, in order to swell the PnBA phase, and partial quaternization/complexation to reduce the PDM/MO proportion. Some elasticity was successfully introduced through partial quaternization of the PDM block, but the material was not mechanically stable. PDM-PnBA-PDM triblock copolymers with shorter PDM blocks and/or a longer PnBA block are currently being synthesized to determine the necessary composition for the targeted properties.

[1] Q. Zhang, X. Wang, C. J. Barrett, C. G. Bazuin, Chem. Mater., 2009, 21, 3216

1) Jing Sun (Université de Montréal): **Stability of hydrogel nanoparticle monolayers covalently grafted on functionalized mica substrates**

2) Amine Fourati (Université de Montréal): **Photophysical and crytallographic studies of 2,5-*bis*(5-tert-butyl-benzoxazol-2-yl)thiophene: a potential new probe for polymer aggregate studies**

3) Ezequiel R. Soule (McGill University): **Thermodynamic modelling of phase equilibrium in nanoparticle-liquid crystals mixtures**

4) Xiaohong Wong (Université de Montréal): **Morphology of poly(L-lactide)/poly(D-lactide) stereocomplex crystallized in ultrathin films**

5) Karina Carneiro (McGill University): **Self-assembly of DNA-dendritic polymer conjugates**

6) Julian Silverman (McGill University): **Biginelli reaction catalyzed by magnetically recoverable nanoparticles**

7) Cheng Bian (Concordia University): **Chiral crystallization and chiral amplification of guanidinecarbonate, phenyl disulfide and benzil**

8) Xiaoxiang Wang (Université de Montréal): **Dynamic behaviour and electrospinning of photactive polymer-azobenzene supramolecular complexes**

9) Milad Abou Dakka (McGill University): **Model of actuation in flexoelectric membranes**

10) Janaina Gomes Ferreira (Université de Montréal): **Synthesis of organic chromophores based on the quinolium moiety**

11) Amlan Kumar Pal (Université de Montréal): **A self-assembly approach to light-harvesting chromophores**

12) André Bessette (Université de Montréal): **Re(I) complexes: From molecular antenna to anion sensors**

13) Bin Yan (Université de Sherbrooke): **Photoresponsive Vesicles with a Liquid Crystal Polymer Membrane**

14) Daniel Chartrand (Université de Montréal): **Rhodium dimers as hubs for photo-harvesting antennas**

15) Katherine Castor (McGill University): **Platinum(II)-based anticancer therapeutics**

16) Yogesh Kumar Murugesan (McGill University): **Analysis of the microfibril organization modes emerging in plant cell walls of variable curvature**

17) George Rizis (McGill University): **Morpholgical transitions induced by core crystallization in poly(ehtylene oxide)-*block*-poly(caprolactone) micelles**

18) Chaoying Fu (McGill University): **Self-assembly of oligothiophenecarboxylic acid monolayer by Scanning Tunnelling Microscope (STM)**

19) Carolin Madwar (Concordia University): **Perfluorophenyl azid immobilization chemistry for the single molecule force spectroscopy investigation of the concanavalin A/mannose interaction**

20) Robert Poulin (University of Montreal): **Model stratum corneum lipid mixtures: A study by infrared microspectroscopic imaging**

21) Maksym Kryuchkov (Université de Montréal): **High molecular weight linear block copolymers of poly(L-lactide) and poly(2-dimethylaminoethyl methacrylate): synthesis and nanopatterning**

22) Eric Charrault (Université de Montréal): **Investigation on the molecular shear-induced organisation of confined thin films**

23) Renata Vyhnalkova (McGill University): **Block copolymer micelles and emulsions for bactericidal filter paper**

24) Olga Borozenko (Université de Montréal): **Real-time fluorimetric degrafting detection of covalently attached fluorescent polymer brushes from silica substrates – effecs of pH and salt**

25) Julien Breault-Turcot (University of Montreal): **SPR for sensing at nM levels in undiluted biological fluids with micro-patterned Au**

26) Jean-François Wehrung (Université de Sherbrooke): **Polymer Micelles for Stabilizing Organic Photosensitizers for electron transfer to methylviologen**