

9 POLYCOLL (POLYMERS AND COLLOIDS)

ORGANISED IN CONJUNCTION WITH THE "POLYMERS AND COLLOIDS" DIVISION OF THE
SWISS CHEMICAL SOCIETY.

Monday, 21.06.2010, Room 120

Time	ID	POLYCOLL <i>Chair: W. Meier, Uni Basel</i>
13:50		<i>Welcome Note</i>
14:00	901	<p>Nitroxides containing polymers as novel redoxactive electrode materials for Li-ion batteries</p> <p><i>Peter Nesvadba, BASF Schweiz AG, Schwarzwaldalle 215, 4002 Basel</i></p> <p>Nitroxide radicals undergo one-electron reduction or oxidation affording the corresponding hydroxylamine anions or oxoammonium cations. The redox couple nitroxide/oxoammonium (and to a much lesser extent the nitroxide/hydroxylamine anion couple) is for many (but not all) nitroxides electrochemically reversible and its redox potential E_0 depends in a predictable way on the nitroxide structure.</p> <p>The lecture will focus on the from a practical point of view more important nitroxide/oxoammonium couple. It will first discuss the structural parameters influencing its reversibility and its redox potential E_0. Quantum chemical methods as an efficient tool for prediction of E_0 will be highlighted.</p> <p>The second part will present novel polymers bearing pending nitroxide groups. The aforementioned nitroxide/oxoammonium redox reaction is the basis for the use of such redoxactive polymers as novel electrode materials in organic radical Li-ion batteries [1].</p> <p>The lecture will consist of work conducted in our laboratories [2,3] as well as of selected highlights from the recent literature.</p> <p>[1] K. Nakahara, S. Iwasa, M. Sato, Y. Morioka, J. Iriyama, M. Suguro, E. Hasegawa, Chem. Phys.Lett. 2002, 351. [2] L. Bugnon, C. J. H. Morton, P. Novak, J. Vetter, P. Nesvadba, Chem.Mater. 2007, 2910. [3] P. Nesvadba, L. Bugnon, P. Maire, P. Novak, Chem.Mater. 2010, 783.</p>
14:30	902	<p>Nanostructured layers with selected chemical and optical properties</p> <p><i>Rita Hofmann, ILFORD Imaging Switzerland GmbH</i></p> <p>Aqueous high speed web coating of multi-layers is a cost effective, precise and economic process to produce large areas of homogeneous nanostructured films or papers. The layers' special chemical and optical properties can be fine-tuned to different applications for example as absorbing layer for ink-jet ink or as reflective or insulating films. The multi-layer structure allows to combine several different functions in one flexible film element. Examples of the potential of such films are in lighting, security, printing and sensors</p>

15:00	903	<p style="text-align: center;">Advanced eco friendly waterborne coatings due to a novel nanoscaled additive</p> <p style="text-align: center;"><i>Detlef Burgard, Bühler PARTEC GmbH</i></p> <p>One of the most important and technologically relevant ways to reduce VOC emissions from coatings is to switch from solvent borne to waterborne coatings. However, waterborne coatings still cannot fully replace solvent borne alternatives due to their sometimes poorer performance. So there is a steady need to further improve waterborne coating materials.</p> <p>It is demonstrated how a nano particle based additive can significantly improve the overall performance of waterborne coatings. It could be shown that the positive effect of this additive is not restricted to single substrates or applications only. The present study demonstrates how a nano particle based additive can successfully be used in wood coatings, metal protective coatings, both DTM and primer top coat systems as well as in coatings for plastics. In all cases, already small amounts of a nano particulate additive are sufficient to deliver remarkable improvements on properties like chemical resistance, humidity resistance, weathering resistance, blocking resistance or drying time.</p>
15:30		<p>Coffee Break</p>
		<p><i>Chair: B. Steinmann, 3D Systems SA</i></p>
16:00	904	<p style="text-align: center;">Polymers in the textile process chain</p> <p style="text-align: center;"><i>Jochen Stock, Clariant Products (Switzerland) Ltd., 4153 Reinach</i></p> <p>Polymers are ubiquitous process auxiliaries for the production of textiles. Throughout the whole textile process chain - from the spinning of fibres and yarn to the functionalisation of textiles - they play an important role.</p> <p>One on side the use of polymers can be as simple as the application of sequestering agents. But the development work in the last years focused on more and more complex systems to create functionalised, textile surfaces.</p> <p>A few examples of the application of polymers in the manufacturing of textiles will be highlighted in the presentation.</p>
16:30	905	<p style="text-align: center;">Nanosized Polymeric Structures in Dental Tissue Regeneration</p> <p style="text-align: center;"><i>Aart Molenberg, Institut Straumann AG, Basel</i></p> <p>Emdogain© is a dental medical device containing the Enamel Matrix Derivative (EMD) protein mixture as its main constituent. It is applied to the tooth root to initiate the regeneration of periodontal tissues lost due to periodontitis. Since Emdogain acts through cell-matrix interactions between EMD aggregates and the cells of the remaining periodontal ligament, the solution and aggregation behavior of EMD is of high interest.</p> <p>The solubility of EMD is strongly pH and temperature dependent and at physiological conditions, close to its isoelectric point, EMD is largely insoluble. Its behavior in solution as well as its interactions with a surface has been investigated for various pH values between 4.0 and 9.0 at temperatures between 0°C and 37°C.</p> <p>The layer thickness of the adsorbed EMD was thickest at pH 7.0 (90 nm) and thinner at pH 4.0 (4.1 nm) and pH 8.0 (11.9 nm). EMD was found to adsorb as nano-spheres in mono- or multilayer, depending on pH. Furthermore, Dynamic Light Scattering (DLS), transmission electron microscopy (TEM), and atomic force microscopy (AFM) analysis indicated that the self-assembly of EMD is primarily triggered by the</p>

		temperature, since increasing temperature leads to larger self-assembled nano-spheres with hydrodynamic radii from 16 - 29 nm at 20°C up to 37 - 107 nm at 37°C. The compounds of EMD involved in the self-assembly process were analyzed by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) and 2D gel electrophoresis followed by the protein identification via tandem mass spectrometry. The main compound involved in the self-assembly process was found to be the 20 kDa amelogenin, while ameloblastin and blood constituents stay dissolved in the buffer.
17:00	906	<p align="center">Polymer mobilisation and drug substance dynamics in dissolving pharmaceutical solid dispersions</p> <p align="center"><i>Michael Schuleit, Novartis AG</i></p> <p>Solid dispersion constitute a favorable approach for enhancing the oral bioavailability of poorly water soluble drugs. Although the term solid dispersion remains somewhat ambiguously defined the aim when preparing the material is to disperse a hydrophobic drug within an inert hydrophilic polymeric matrix. One of the purposes is to improve the wetting and thereby improve the dissolution behavior of the dispersed and matrix incorporated drug.</p> <p>However, the predictability of complex solid dispersions tablets is often hampered by the lack of information about the intrinsic material properties. In particular it is difficult to know whether e.g. the drug is molecular dispersed or if in form of particles, what is the particle size, whether the particles are amorphous or crystalline (especially when the drug is in the nanometer size range), or how material wettability or polymer drug interaction impact polymer swelling dynamics a prerequisite for drug release etc.</p> <p>During the presentation a general overview will be presented to show how material science concepts and information improve the understanding and predictability of solid dispersions followed by a specific example how a combination of localized NMR spectroscopy and NMR imaging allow the observation of in situ drug recrystallisation within the complex material structure for which we tentatively identify nanoparticle coalescence as the nucleating event.</p>
17:30		<i>Closing Remarks</i>
17:45		END

ID		POLYCOLL POSTER	
911	Drying-mediated assembly of colloidal particles		
	<p><i>Cyrrill Kümín^{1,2}, Cathrein Hückstädt^{1,2}, Emanuel Lörtscher¹, Antje Rey^{1,3}, Nicholas D. Spencer², Heiko Wolf¹</i></p> <p>¹ IBM Research - Zürich, Säumerstrasse 4, 8803 Rüschlikon ² Department of Materials, ETHZ, Wolfgang-Pauli-Strasse 10, 8093 Zürich ³ Department of Mechanical and Process Engineering, ETHZ</p>		
	<p>Drying-mediated assembly is an efficient and versatile method to pattern colloidal particles on surfaces [1,2]. We will report here on the use of dedicated templates in drying-mediated assembly processes under controlled conditions to pattern particles into architectures difficult to obtain by other means.</p> <p>In this context, we recently showed that spherical sub-micron polymer particles can be assembled in a size-selective manner by tuning capillary and confinement forces governing the assembly mechanism. This allowed fabricating multi-particle patterns without the need for specific surface chemistries [3].</p>		

	<p>On a smaller scale, gold nanorods have attracted attention due to their versatile surface chemistry and shape-/direction-dependent optical properties. Consequently, methods to orient them are highly sought after; a challenge we are currently tackling by drying-mediated assembly.</p> <p>[1] Malaquin et al., <i>Langmuir</i>, 2007, 11513 [2] Kraus et al., <i>Nature Nanotechnology</i>, 2007, 570 [3] Kuemin et al., <i>Advanced Materials</i>, accepted in March 2010</p>
<p>912</p>	<p style="text-align: center;">AFM Study of Polyacrylic Acid Adsorption on Calcite</p> <p style="text-align: center;"><i>Laura Muresan, Prashant Sinha, Plinio Maroni, Michal Borkovec</i> <i>Department of Inorganic, Analytical and Applied Chemistry, University of Geneva,</i> <i>30, Quai Ernest Ansermet, 1211 Genève</i></p> <p>Calcite (CaCO₃) is known for its wide applications in various industries (plastic, paper, paints, cement etc.). Due to its tendency to agglomerate and its instability in humid environments [1, 2], numerous attempts have been made to understand and control the properties of calcite surfaces [3]. One common way to stabilize the CaCO₃ suspensions is to use polyacrylic acid (PAA) as dispersing agents [3].</p> <p>In the present work, atomic force microscopy (AFM) was used to investigate the adsorption behavior of high molecular weight PAA on calcite surfaces. All measurements were performed in tapping mode, in air, at room temperature. In all cases, PAA adsorbs as multimolecular aggregates of globular shape, as subsequently proved by volume analysis of these globules. The effects of adsorption time, PAA concentration, post-adsorption washing and ionic strength were studied. AFM imaging shows that (i) longer adsorption times do not have any significant effect on the amount of PAA adsorbed on calcite; (ii) the adsorbed mass increases with increasing PAA concentration; (iii) the calcite bound PAA aggregates reveal molecular networks upon washing with water and subsequent flux drying and, (iv) the increase of ionic strength favors the adsorption of PAA.</p> <p>[1] Baltrusaitis J., Grassian V. H., <i>Surf. Sci.</i> 603 (2009), L99-L104. [2] Karoussi O., Skovbjerg L. L., Hassenkam T., Stipp S. L. S., Hamouda A. A., <i>Coll. Surf. A: Physicochem. Eng. Aspects</i> 325 (2008), 107-114. [3] Eriksson R., Merta J., Rosenholm J. B., <i>J. Coll. Interf. Sci.</i> 313 (2007) 184-193.</p>
<p>913</p>	<p style="text-align: center;">Ag-Nanoparticle Formation in Different Sizes Controlled by Peptides</p> <p style="text-align: center;"><i>Conelious Pfumbidzai, Gregory Upert, Helma Wennemers</i> <i>Organic Chemistry Department, University of Basel, St. Johannis Ring 19, 4056 Basel</i></p> <p>Silver-nanoparticles (AgNPs) are recently finding great and diverse applications in areas like imaging, catalysis and antimicrobial agents. Previously, we introduced colorimetric on-bead screening of a split-and-mix library for the identification of peptides that control the formation of AgNPs in different sizes. The NPs generated by the peptides immobilized on a solid support are stable for months. The generation of stable AgNPs in solution phase proved to be a larger challenge. We will demonstrate how careful adjustments of the conditions allowed for increasing the stability of the AgNPs also in solution phase. In addition, initial experiments to evaluate the antibacterial activity of the AgNPs generated in the presence of different peptides will be presented.</p> <p>[1] M. B. Dickerson, K. H. Sandhage, R. R. Naik, <i>Chem. Rev.</i> 2008, 108, 4935. [2] K. Belsler, T. Vig Stenters, C. Pfumbidzai, G. Upert, L. Mirolo, K. M. Fromm, H. Wennemers, <i>Angew. Chem. Int. Ed.</i> 2009, 48, 3661.</p>

<p>914</p>	<p>Creating hematite pillar structures using electrohydrodynamic instability</p> <p><i>Rita Toth¹, Artur Braun¹, Jakob Heier², Mateusz Schabikowski³, Thomas Graule¹</i></p> <p>¹ <i>Laboratory for High Performance Ceramics, EMPA, Überlandstrasse 129, 8600 Dübendorf</i></p> <p>² <i>Functional Polymers, EMPA, Überlandstrasse 129, 8600 Dübendorf</i></p> <p>³ <i>Fac. of Materials Science and Ceramics, AGH -The Univ. of Science and Technology, Mickiewicza Avenue 30, PL-30-059 Krakow</i></p> <p>Soft lithographic methods developed to structure organic resists is increasingly used to pattern inorganic materials. We combine sol-gel chemistry and a recent lithografic method, ie. electrohydrodynamic instability, used to produce sub-micrometer patterns in polymer films to create hematite pillar structures. Hematite is an attractive candidate as a photoanode for solar energy driven splitting of H₂O in photoelectrochemical cells due to its abundance, low cost, chemical stability in aqueous environment and suitable band gap. However, hematite has a short hole diffusion length, therefore micro- and nanostructuring its morphology is a great interest.</p>
<p>915</p>	<p>Automated Synthesis of Methacrylate (MA) Polymers using RAFT</p> <p><i>Amira Abou-Hamdan¹, Nicole Harris², Karolina Piotrowska², Michael Borher², Joachim Kohn²</i></p> <p>¹ <i>Chemspeed Technologies, Rheinstrasse 32, CH-4302 Augst</i></p> <p>² <i>Department of Chemistry & Chemical Biology, Rutgers, the State University of New Jersey and New Jersey Center for Biomaterials, USA</i></p> <p>It was the goal of this study, to create a polymethacrylate library for the rapid screening of cell-material interactions and the development of <i>in silico</i> modeling technique. Polymethacrylates are widely studied and used for intraocular lens, orthopedic applications, bone cement, and cartilage substitutes.</p> <p>A library of these polymers has not yet been explored for studies of biological interactions. This was the first study with a polymer library of this size (> 40,000 polymers). Approx. 100 polymers were synthesized for the use as a training set for a computational model, to subsequently demonstrate the value of computational modeling. The study also did validate the effectiveness of Chemspeed's Automated Synthesizer "Acelerator SLT100".</p>