CPP 49: Hydrogel und Microgel

Time: Wednesday 17:15–18:30 Location: H18

Invited Talk CPP 49.1 Wed 17:15 H18

Stimuli-Responsive Polymer-Based Sensors, Muscles, and Drug Delivery Platforms — •Michael Serpe — University of Alberta, Edmonton, AB, Canada

The group's research is focused on the development of novel polymer-based materials for solving environmental and health-related problems. To solve these problems, the group primarily employs poly (N-isopropylacrylamide) (pNIPAm)-based spherical particles as the active component in our technologies. PNIPAm-based particles (nano or microgels, depending on their diameter) are extremely porous, and are fully water soluble and swellable. Additionally, pNIPAm-based nano/microgels are responsive to temperature, shrinking in diameter as the temperature is increased to >32 °C and reswelling when they are cooled to < 32 °C. Our group has exploited these properties for numerous applications. Today's talk will highlight the group's work on the development of these devices for sensing and biosensing, as muscles, and for controlled/triggered drug delivery.

CPP 49.2 Wed 17:45 H18

Multiresponsive PNIPAM Microgels Doped with Magnetic Nanoparticles — •Marcus U. Witt[1], Nadir Möller[1], Melissa Hess[2], Stephan Hinrichs[3], Birgit Fischer[3], Anette Schmidt[2], and Regine v. Klitzing[1] — [1]Technische Universität Darmstadt, Institut für Festkörperphysik, Alarich-Weiss-Straße 10, 64287 Darmstadt — [2]Universität zu Köln, Institut für Physikalische Chemie, Luxemburger Straße 116, 50939 Köln — [3]Universität Hamburg, Institut für Physikalische Chemie, Grindelallee 117, 20146 Hamburg

Microgels based upon N-isopropylacrylamide (NIPAM) exhibit a volume phase transition at a temperature of 32°C (VPTT) in water. Several additives can be used to tailor physical and chemical properties. Co-monomers are incorporated to induce a response mechanism to pH or ionic strength. Non-organic particles can be loaded into the microgel to add a response to external stimuli such as light and magnetic fields. The present study addresses microgels with different inner structures (heterogeneous, homogeneous, *onion-like*) loaded with magnetic nanoparticles (MNP) leading to different MNP distribution. The effect of MNP loading on the VPTT is studied by light scattering and zeta potential measurements. The response of those ferrogels to external magnetic fields is investigated in bulk and at the surface. Magneto-relaxation measurements show unexpected and counterintuitive results, leading to the conclusion that the MNP rearrange while crossing the VPTT.

CPP 49.3 Wed 18:00 H18

Incorporation of conductive materials in stimuli-responsive hydrogel films synthetized by ionizing radiation for the development of biomedical sensor applications — •Jesus Eduardo Lopez-Barriguete[1,2], Gabriel Flores-Rojas[1,2], Felipe Lopez-Saucedo[1], Takashi Isoshima[2], and Emilio Bucio[1] — [1]Departamento de Química de Radiaciones y Radioquímica, Instituto de Ciencias Nucleares, Universidad Nacional Autónoma de México, Circuito exterior, Ciudad Universitaria, Ciudad de México 04510, México — [2]Nano Medical Engineering Laboratory, RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan

Stimuli-responsive systems of co-polymeric hydrogels with a specific temperature (38 and 39 *C) response has been prepared and modified to elaborate adaptable films for biomedical and nanotechnology applications. The principal thermo-responsive polymer is N-isopropyl acrylamide (PNIPAAm) with the addition of dimethyl acrylamide (DMAAm) for temperature modification, methyl methacrylate (MMA), and ethoxyethyl methacrylate (EEM) for mechanical improvements. Ionizing radiation technique (gamma rays) allows synthesizing different systems at a dose radiation of 50 kGy. The matrix modification with silver and copper incorporation was by chemical synthesis. The conductive properties of these materials and biocompatibility could permit the addition of electrical properties to the films admitting electrical changes by the internal structure variation of the polymeric chains due to the temperature variability. All the samples were characterized by FT-IR, DSC, SEM, and EDX.

CPP 49.4 Wed 18:15 H18

Non-additive ion effects on polymer coil-globule collapse transitions in mixed salt solutions — •Nico van der Vegt[1], Ellen E. Bruce[1], Pho T. Bui[2], Bradley A. Rogers[2], and Paul S. Cremer[2] — [1]Technische Universität Darmstadt, Germany — [2]Pennsylvania State University, USA

Non-additive ion effects in Hofmeister ion chemistry impact properties of aqueous soft matter but are poorly understood to date. I will present ion-specific effects on the lower critical solution temperature of poly(N-isopropylacrylamide) in mixed electrolyte solutions. Significantly, I will show that polymer hydration and polymer-anion interactions can be regulated in the presence of weakly (NaI) and strongly hydrated (Na2SO4) mixed salts, leading to both collapse and swelling of the polymer. The underlying mechanisms are discussed based on insights obtained from computer simulations and vibrational sum frequency spectroscopy (VSFG) experiments.