

Symposium on Rheology of Complex Fluids and Honorary Symposium for Pierre Carreau during the 66th Canadian Chemical Engineering Conference

QUEBEC CITY, CANADA
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The Canadian Society of Rheology hosted a symposium on the Rheology of Complex Fluids on October 18–19, 2016 during the 66th Canadian Chemical Engineering Conference in Quebec City. The conference, coorganized by the Canadian Society for Chemical Engineering, CSChE, and Université Laval, was attended by more than 1100 chemical engineers from around the world, and had a theme of “Sustainability and Prosperity”.

The symposium included three half-day sessions, and was offered jointly with the honorary symposium in recognition of Pierre Carreau for outstanding contributions in Rheology and Polymer Nanocomposites. The sessions included a wide array of topics, ranging from the rheology of polymer melts and composites, to solutions, suspensions, colloids and gels. All sessions were very well attended and the wide variety of contributions represented the diversity of research conducted in Canada. International contributions from the Instituto Tecnológico de Calaya, Mexico and the Tianjin University of Science and Technology were also presented. The entire program is available through the conference link: <http://www.csche2016.ca/program-o>

Highlights included the keynote speeches by A. Jeffrey Giacomin and Daniel DeKee. J. Giacomin presented the exact analytical solution for large-amplitude oscillatory shear flow using the Oldroyd 8-constant model. He highlighted the importance of the corrotational Maxwell model derivative in describing LAOS flows, and derived the exact analytical solution for shear stress based on the Oldroyd 8-constant model.

After reflecting on the state of research in Academia and Industry, D. DeKee elaborated on the discontinuities in various physical phenomena, as observed in rheology. These include stress jump, on startup or cessation of a deformation; bubble velocity jump discontinuity; and yield stress behavior. The session on polymer melts included topics ranging from the role of thermodynamics in rheology by M. Grmela, and the description of an eccentric cylindrical coordinate system to develop elegant analytical solutions of the equations of motion, from the group of J. Giacomin, to the modification of the rheological properties of PLA by reactive extrusion, studies on shear induced crystallization of PLA presented by the group of M. Kontopoulou and simultaneous reactive extrusion of PLA with plasticization, from the group of M. Huneault.

The honorary symposium session on nanocomposites covered a wide variety of composite systems. U.T. Sundararaj discussed the application of electric fields to induce exfoliation and intercalation in HDPE/clay nanocomposites. The electrorheological response of these samples is a very sensitive means to detect changes in the microstructure of the nanocomposites. F. Mighri presented his work on electrically conductive nanocomposites used for fuel cell applications. He showed how surface modification of Multiwall carbon nanotubes helped to significantly increase the electrical conductivity of cocontinuous morphology PVDF/PET-based nanocomposites. Contributions by the groups of P. J. Carreau and M.-C. Heuzey, on PEO/cellulose nanofiber composites and on gels of electrostatically stabilized nanocrystals of cellulose in water were also presented in this session. Talks of industrial interest included an examination of PLA/ZnO nanocomposite electrospun fibers as food packaging biomaterials

Photo Credit: Office du tourisme de Québec



Figure 1: Quebec City.

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and the use of surface modified carbon nanotubes for bipolar plates in fuel cell applications.

A stimulating talk on novel self-propelling Janus particles in weakly viscoelastic media, was presented by G. Natale, formerly from the group of S.G. Hatzikiriakos, UBC, and currently at the University of Calgary. These colloidal particles self-propel by creating asymmetric concentration gradients across their interfacial region, thanks to an asymmetric surface distribution of a catalyst. The session concluded with a talk by N. Nazemifard of the University of Alberta on the development of a microfluidic device to measure small yield stresses, which cannot be detected in commercial rheometers. This was applied to study the yield stress of diluted bitumen.

Diverse systems of interest to Chemical Engineering were covered in the session on solutions, suspensions, emulsions, colloids and gels. Many talks focused on the significant challenge of separation of extremely fine water droplets, which form emulsions with bitumen obtained from oil-sands and are the cause for corrosion in downstream processes. Potential approaches include the formation of larger water drops, by coalescence, which can be then be removed using conventional means. A. Ramachandran from the University of Toronto presented a microfluidic device, developed specifically to study coalescence in highly concentrated bitumen solutions. The role of asphaltenes, which are a main component of oil are surface active components,

which form a rigid film in the water oil interface, and are thus linked to the stability of the water/oil emulsions was also investigated by the groups of H.W. Yarranton, and S. Zhang, of the Universities of Calgary and Alberta respectively. Finally, talks relevant to food rheology included the use of Crystalline Nanocellulose to stabilize gelatin encapsulated tea polyphenols, studies of the synergistic gelling properties of mixed gelatin B and xanthan gum solutions, investigations of the rheological characteristics of sesame proteins in solution.

The CSR is grateful to the Conference organizers, the conference chair Alain Garnier, technical program chair Faïçal Larachi and Frej Mighri, who co-organized the symposia with Marie-Claude Heuzey and Marianna Kontopoulou, and Uttandaraman Sundararaj, Nick Virgilio and Arun Ramachandran who co-chaired the sessions.

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Figure 2: Jeffrey Giacomini, Daniel DeKee and Pierre Carreau at the honorary symposium.

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