

## QCAM at the Canadian Chemistry Conference

*A rich programme featuring the annual meeting, four invited speakers and the general assembly. The icing on the cake, three awards were presented to our researchers*

This year, the QCAM annual meeting was held during the 102<sup>nd</sup> Canadian Chemistry Congress, which took place at the Quebec Conference Centre from 3 to 7 June.

### From interfaces through membranes

The exciting programme of activities started with the first talk by one of the QCAM invited speakers, [Prof Bernard Lestriez](#) (Institut des Matériaux Jean Rouxel, Nantes), who addressed a fascinating subject, the anode materials for Li-ion batteries. This talk emphasised the formidable challenges that researchers need to confront before we can achieve the widespread uptake of silicon as anode material. This element features a lithium storage capacity significantly larger than graphite; nevertheless, a severe volume expansion during lithiation-delithiation brings about a poor mechanical stability. In this respect, Prof. Lestriez discussed several available binders, showing how they can contribute to improving the electrode cyclability. In addition, coordination bonds play a key role in enhancing the electrode stability.

The second invited speaker, Prof. [Hedi Mattoussi](#) (Florida State University) focused on the bottom-up synthesis of inorganic nanocrystals. Their photophysical properties can be tailored by controlling their size and shape. This makes these versatile materials extremely promising for several applications, for instance in the biomedical field. However, the nanocrystals must be functionalised according to the desired final application. To this aim, Prof Mattoussi's group has designed polymeric ligands which can bind to a broad range of nanocrystals, from quantum dots to gold or iron oxide nanoparticles. These ligands can be further derivatised to achieve an even finer level of control over their properties. These inorganic-polymeric materials have been employed for the imaging of living cells.

Later on, Prof. [Ayyalusamy \(Rams\) Ramamoorthy](#) (University of Michigan) presented an overview of the latest findings obtained by his research group, specialising in the NMR of membrane proteins in solution and in the solid state. The first part of the talk addressed the determina-



tion of the structure of cytochrome P450 and of the configuration of its transmembrane domains. This work also unveiled the interactions between the enzyme and the membrane lipids. A biomimetic approach based on the use of lipid nanodiscs was instrumental in recreating some portions of the membrane structure, leading to significant breakthroughs. Secondly, Prof. Ramamoorthy described the results provided by NMR measurements on the structure and the formation of beta-amyloid aggregates; these findings also provide evidence of the disruptive effect of these aggregates on the cell membrane.

### The QCAM symposium on functional materials.

The full-day symposium on functional materials sponsored by QCAM was held on Friday, 7<sup>th</sup> June. It featured a broad range of topics and gave centre stage to PhD students coming from all across Canada. On the programme: 21 talks including a keynote lecture given by Prof. [Xuhui Sun](#) (Suzhou University), the fourth QCAM invited speaker.

The first part of the symposium was devoted to polymers: universal crosslinkers, functionalisation through click chemistry, self-assembly of block co-polymers. The latter also featured in a talk on the synthesis of a well-defined polymer composed of silicone and eugenol derivatives. The preparation of superhydrophobic polydimethylsiloxane was also addressed. Among the several applications of polymers presented in this session, we should mention actuators based on electroactive liquid crystal polymers and the fabrication of composite stimuli-sensitive materials. In conclusion, we also learnt the vast potential of ionic liquid beyond their simple role as reaction solvents.

The afternoon session addressed various aspects of colloid

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and surface chemistry: 1- and 2D nanostructures composed of block co-polymers; cocoa butter crystallisation; superhydrophobic materials and a related application, “Janus” filters with a different wettability on each side. Those keen on “hard” nanotechnology must have enjoyed the talks on the preparation of  $\text{LiNbO}_3$  and  $\text{Cu}_2\text{O}$  nanoparticles, but also the presentation on synthetic routes to obtain thin-film black phosphorous. As for energy applications, we learnt more about novel, more environmentally-friendly hypergolic fuels, but also, in a vivid contrast, about cellulose-based flame retardants. The energy theme also ran through a talk on biofilm formation in biofuel cells and the keynote lecture by Prof. Sun. Our invited speaker discussed triboelectric nanogenerators (TEENG), devices able to har-

vest and convert mechanical energy into electrical energy. The triboelectric effect arises when two materials having a different permittivity are brought into contact or rub against each other. TENGs lend themselves well to low-frequency applications, such as the capture of wave energy or that generated by body movements. Prof. Sun’s research also aim at the design of energy harvesting devices, including materials optimisation (silicone rubber, galinstan—an alloy composed of Ga, In, Sn). In addition, he also works on the combination of TENGs with other devices, such as photovoltaic cells or sensors incorporated in wearable electronics.

*The next QCAM annual meeting will be held at McGill*

## Congratulations to our three award-winners!

**Tomislav Friščić** (McGill) received the Award for Research Excellence in Materials Chemistry. His re-



search focusses on novel synthetic routes to metal organic frameworks (MOFs): solvent-free mechanochemistry, geochemically-inspired low-energy accelerated aging and MOF assembly in supercritical carbon dioxide. Prof. Friščić’s study of the relation between MOF structure and thermodynamic stability has inspired the design of high-energy hypergolic MOFs. In his talk, he also cited Theophrastus’ treatise *On stones* (4<sup>th</sup> century BC), reminding that MOFs play a geological role as minerals.



**Jean-François Masson** (Université de Montréal) was awarded the 2019 W.A.E. McBryde medal in recognition of his research on analytical chemistry. At CCCE 102, Prof Masson presented his work on nanoplasmonic sensors for biological and environmental monitoring in complex matrices. As an example, a surface plasmon resonance chip which allows the detection of explosives in water at ppb levels. The same approach can be exploited for the real-time monitoring of methotrexate in serum. This is a remarkable achievement, considering the interference caused by the non-specific adsorption of serum components. A third research programme aims to design plasmonic nanopipettes for the detection of cell secretion event, targeting analytes such as cell metabolites or neurotransmitters.

**Christopher Barrett** (McGill) received the Macromolecular Science and Engineering Award. Research in the



Barrett Group develops polymers that can respond reversibly to visible light, providing stimuli-responsive materials for a variety of applications as optical devices, smart bio-materials, and environmentally-degradable plastics alternatives.



## 2019 General assembly

The 2019 QCAM general assembly took place on Thursday, 6<sup>th</sup> June. The QCAM director, Michel Lafleur (Université de Montréal) presented the executive summary of the year 2018-2019; its main points are very positive. . The QCAM annual report is available [online](#). Theo Van de Ven’s (McGill) term of office as QCAM director will begin in April 2020. The electoral process to appoint the new executive board members will unfold as of January 2020. The By-laws of QCAM were also adopted by unanimous vote. In conclusion, we remind that the next annual meeting will be organised at McGill.

# QCAM: gold sponsor at CCCE 102 !

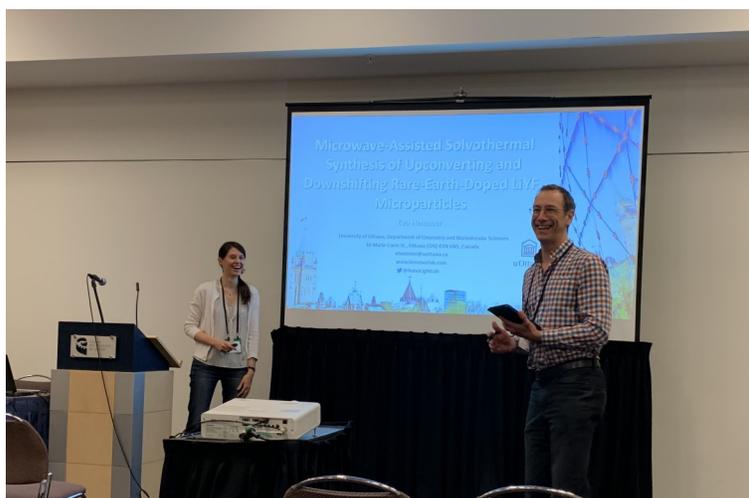


## Photo gallery

*Symposium in honour of Robert Prud'homme*



*The director as chair*



*Solid-state NMR - in memory of Michèle Auger*



*Attentive attendees*



*In the next issue: science outreach, professional careers after QCAM and much more!*