

# McGill Chemistry Seminar

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Dr. Alex Bushuyev, University of Toronto

Tuesday, September 5th | 1 pm, **Otto Maass Room 10**

**Title:** Two tales of energy conversion: How we can make molecules move large objects, and can we really store energy in CO<sub>2</sub> gas?

**Abstract:** Sometimes energy transformations by molecules come in surprising forms, such as conversion of light into mechanical motion. In the first part of the talk I will focus on this fairly unknown application of azobenzene photo-switching dyes – the photo-mechanical effect. As it happens, even in the solid state azobenzenes exhibit enough mobility to photoisomerize. Collective isomerization of many molecules allows one to modify the shape of plastics (and even crystallized objects!) using a light source as inexpensive as a laser pointer. This work performed at McGill over the last several years allowed a glimpse into a mechanism of this new and fascinating photo-mechanical phenomenon.

When one needs to make energy conversion practical, not merely promising, one would have to work at a much larger scale. In the second part of the talk I will examine whether there's hope for storing electrical energy in CO<sub>2</sub> *via* its electrocatalytic conversion into chemical fuels. The electrochemical conversion of CO<sub>2</sub> to fuels and feedstocks - the CO<sub>2</sub> reduction reaction – may become an elegant solution to closing the carbon cycle, when powered by renewable energy. I will discuss how the electrochemical transformation of renewable energy into fuels using captured CO<sub>2</sub> offers the prospect of long-term, large-scale, seasonal energy storage, which allows for integration of renewable electricity into transportation systems and chemical production.



**Alex Bushuyev** writes that he: “earned B.S. and M.S. degrees at Odessa National University, Ukraine when he was still young and naive, and then an M.Sc. at Texas Tech on a Fulbright Fellowship in 2011. He completed his Ph.D. on a Vanier Canada Fellowship at McGill University in 2016, working with C.J. Barrett, on light-responsive and photo-mechanical materials that can be self-assembled, then deformed with light. A wizened, and hopefully wizened, version of Alex is now an NSERC Canada Postdoctoral Fellow in Electrical Engineering at the University of Toronto, working on energy storage via electrocatalytic conversion of CO<sub>2</sub> into chemical fuels.” Alex is McGill’s 2016 Winkler Prize Thesis Prize Winner.

**all are welcome**

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