



BOB AND SIBYL STAIRS CHEMISTRY SEMINARS

Dr. Marek B. Majewski

**Associate Professor, Department of Chemistry and Biochemistry, and
Centre for NanoScience Research, Concordia University**

Wednesday, February 25^h, 2026

11:00 a.m. to 11:50 a.m. in ENW 115

**Capturing and converting photons at molecular photoelectrode and
nanocrystal interfaces**

ABSTRACT

Harnessing sunlight to drive chemical transformations, or to store the sun's energy in chemical bonds, begins with the development of molecules and materials capable of capturing visible light and converting that light into separated charge carriers. To this end, our lab has been investigating nanostructured wide bandgap semiconductor surfaces functionalized with light absorbing molecules that can act as the working electrode in photoelectrochemical cells. Charge separation processes within such hybrid architectures are analogous to the first steps of the electron transfer cascade observed in natural photosynthesis, where light absorption generates redox equivalents that are shuttled to catalytic sites. Several criteria must be met for this type of device to work efficiently including the incorporation of light absorbing chromophores that can deliver multiple redox equivalents to molecular catalysts at rates exceeding those of charge recombination within the cell. Highlighted here are our recent efforts to modify oriented metal oxide nanowires with purpose-synthesized Cu(I)-based donor-chromophore-acceptor triads or donor/acceptor-chromophore dyads and to validate whether the electron transport chain of the full triad is necessary for effective photoelectrode operation. These processes rely on efficient light capture and conversion. To this end, our latest efforts to understand how semiconductor nanocrystals behave in matrices with long-range order will be highlighted. Of focus will be the structural features that define superstructures composed of all-inorganic perovskites and the photonic effects that govern the photophysical properties of perovskite nanocrystal-photonic crystal hybrids.

BIOGRAPHY

Marek B. Majewski is an Associate Professor in the Department of Chemistry and Biochemistry at Concordia University and member of the Centre for NanoScience Research, Centre for Research in Multiscale Modelling, the Centre Québécois sur les Matériaux Fonctionnels (CQMF), and Centre en Chimie Verte et Catalyse (CCVC). He completed his BSc at the University of Saskatchewan in Saskatoon (2007) before traveling to Vancouver to complete his PhD with Prof. Michael Wolf at the University of British Columbia (2013). Prior to joining Concordia University in 2018, he was a postdoctoral researcher at Northwestern University (Evanston, IL, USA) and the Argonne-Northwestern Solar Energy Research (ANSER) Center working with Profs. Michael Wasielewski, Joseph Hupp, and Omar Farha where he also served as the Assistant Director of Operations and Outreach. The Solar Energy Conversion Group at Concordia has been working towards developing and optimizing functionalized nanostructured semiconductor surfaces that act as the working electrode in sensitized photoelectrochemical cells, studying the growth mechanisms of semiconductor nanocrystals, and quantifying the optoelectronic properties of a wide range of inorganic materials.