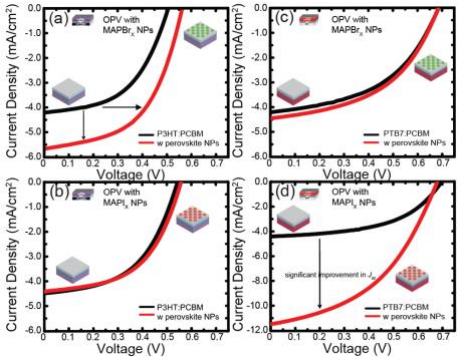
Concordia University
Concordia University
Arts and Science
Department of Physics

TURAK RESEARCH GROUP

MSc and PhD positions (Fall 2023/Winter 2024)
Reactive nano particles for degradation studies in next generation photovoltaic devices
Department of Physics, Concordia University, Montreal Canada
Centre for NanoScience Research (CeNSR)

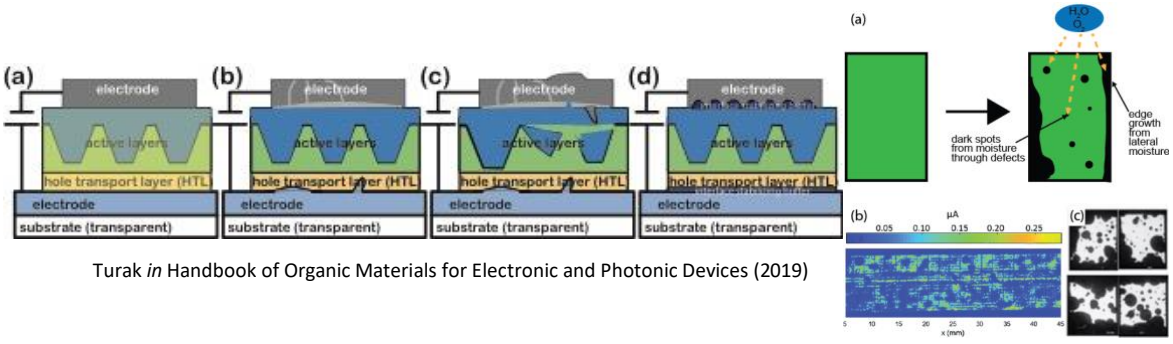
The Turak Functional Nanomaterials Laboratory seeks to revolutionize optoelectronics by making them cheaper, more accessible, and more flexible. Our research focusses on developing easy, versatile, and inexpensive methods of exploring and tuning surfaces using nanoparticle functionalization. To achieve this vision, the Turak group uses simple manufacturing approaches (reverse micelle deposition), allows nature to dictate morphology (entropic self-assembly, beneficial dewetting), and develops characterization tools that are widely applicable to nanotechnology.



M. Munir, Turak *et al.*, Adv. Photonics Res. 3 2100372 (2022)

With a potential global market of $134 billion by 2025, solar cells are one of the most promising alternative energy technologies. Yet they need to be cheap, accessible and flexible for widespread adoption. Organic and perovskite-based photovoltaics offer the best chance of making solar cells a standard fixture on consumer homes. However, their widespread use is limited by short lifetimes, high costs and low efficiencies.

In the proposed project, the student will tackle in particular device degradation by producing at least three varieties of nanoparticle using the reverse micelle deposition approach. By comparing highly reactive, water absorbing and inert nano particles, the student will be able decouple the effects of internal reactions, those from externally supplied water and oxygen and those from a non-homogenous electric field distribution. Nanopatterned electrodes will be incorporated into solution deposited solar cells produced in the integrated glovebox facility in the Turak Laboratory. The dispersion of the various nano particles will be tuned to have the same current density and internal electric field, as determined by electrostatic force microscopy or electrochemical measurements. Accelerated aging of devices will be done using a unique humidity controlled environmental testing chamber, custom built in the Turak Lab, to examine the loss of power conversion efficiency over time. Additionally, the 2D map of decay will be examined visually using photoluminescence and confocal laser scanning fluorescence microscopy to track the formation of "dark" spots.



Turak *in* Handbook of Organic Materials for Electronic and Photonic Devices (2019)

Concordia Department of Physics is a growing department in a university with rapidly increasing rating. We offer research-based M.Sc. and Ph.D. programs. Our faculty members conduct research in the areas of Condensed Matter Physics (theoretical and experimental), Molecular Biophysics, Medical Physics / Imaging, Photonics, Theoretical High Energy Physics, Computational Physics and Physics Education.

Successful applicants will be offered financial packages consisting of RA, TA and various awards of at least 20,000 CAD per year (often more), for 4 years (Ph.D.) or 2 years (M.Sc.). International students will be offered tuition remissions or other awards to compensate for the international tuition fees.

To apply, please send a letter of interest, CV and contact information for two references in a single pdf document, with email subject **"Turak Lab Project Applicant"**. Only applicants considered for employment will be contacted for an interview. **All applications should be sent to Ayse Turak (ayse.turak@concordia.ca)**