UNIVERSITY OF GUELPH | College of Computational, Mathematical, and Physical Sciences
Department of Chemistry

# Departmental Seminar

Monday, July 14, at 10:30 AM
MacN 101


## Prof. Olena Zenkina

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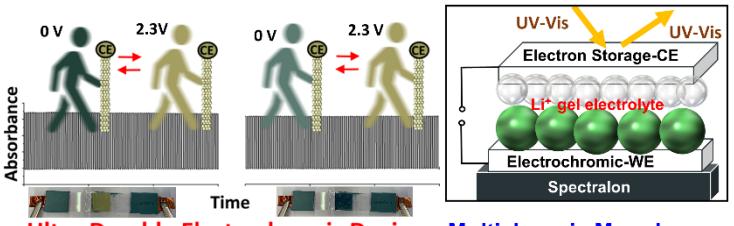
## Title: "Terpyridine-based Hybrid Metal-Organic Electrochromic Materials."


**Abstract:** Electrochromic (EC) devices and "smart" windows represent innovative energy-saving technologies that have the potential to revolutionize the way we manage energy consumption in buildings. These technologies rely on the principle of electrochromism, where materials change colour or transparency when a small electric voltage is applied. "Smart" windows, embedded with EC layers, can adjust their tint in response to environmental factors such as sunlight intensity or temperature, helping to control the amount of heat and light entering a building. EC devices based on transition metal complexes that do not require noble metals benefit from lower cost and colour tunability via molecular design.

Our group developed a strategy that allows the creation of a new class of efficient and robust hybrid EC materials on surface-enhanced conductive metal oxide screen-printed supports. We demonstrated how tuning molecular structures in solution, before deposition or on-surface post-modification, can be utilized to tune the colours of electrochromic monolayers. Notably, the deposition of different transition metal complexes on surface-enhanced support provides the ability to selectively address metal ions in these complexes, enabling multiple colour-to-colour transitions within a single film. It is possibly sequentially switch between multiple coloured states and access effective "colour mixing" on the surface by applying various deposition strategies.[1] Furthermore, tuning the nature and porosity of the conductive surface support could lead to materials with extraordinary coloration efficiencies and ultra-long stability.[2] The energy storage potential of hybrid electrochromic devices was explored, and the role of counter electrodes in device degradation pathways was examined.[3] We studied the role of various components in electrochromic devices in terms of their operation potential window and long-term electrochemical durability. We also explored the nature of the processes at the interface between the electrochromic working electrode, gel electrolyte, and counter electrode.




Ultra-Durable Electrochromic Devices  Multichromic Monolayers

Finally, we developed novel double-sided device configurations that can operate in both unilateral and bilateral modes, demonstrating unprecedented durability and performance characteristics.[4]



1. Laschuk, N. O.; Ahmad, R.; Ebralidze, I. I.; Poisson, J.; Easton, E. B.; Zenkina, O. V., ACS Appl. Mater. Interfaces 2020, 12 (37), 41749-41757. 2. Laschuk, N. O.; Ebralidze, I. I.; Easton, E. B.; Zenkina, O. V., ACS Appl. Mater. Interfaces 2021, 13 (33), 39573-39583. 3. Laschuk, N. O.; Ebralidze, I. I.; Easton, E. B.; Zenkina, O. V., ACS Appl. Energy Mater. 2021, 4 (4), 3469-3479.4. (a) DiPalo, V.-A.; Saeidi, M.; Ahmad, R.; Ebralidze, I. I.; Easton, E. B.; Zenkina, O. V., Sol. Energy Mater. Sol. Cells 2024, 274, 112963; (b) DiPalo, V.-A.; Ahmad, R.; Ebralidze, I. I.; Mapue, N. D.; Easton, E. B.; Zenkina, O. V., ACS Applied Mater. Interfaces 2024, 16 (1), 1082-1095.


**Coffee & Timbits will be served at 10:15 AM**