TRENT UNIVERSITY

CHEMISTRY/PHYSICS SEMINAR SERIES

Dr. Olena Zenkina

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Ontario Tech University

Wednesday, October 11th 2023
11:00 a.m. to 11:50 a.m. in ENW 115

Surface Confined Monolayers for Ultradurable Electrochromic Materials and Devices

ABSTRACT

Electrochromic (EC) devices based on transition metal complexes that do not require noble metals benefit from lower cost and colour tunability via molecular design. Although there is great progress in the development of well-defined EC metal complexes, the design of relevant multicoloured EC films remains a challenging task limited so far by metalorganic polymers. We have demonstrated a strategy that allows the creation of efficient and robust monolayer-based EC materials on surface-enhanced conductive metal oxide screen printed supports. We have observed that making minor changes to the ligand structure can produce materials with a wide range of colour variations. Furthermore, we showed that tuning the nature and porosity of the conductive surface support could lead to materials with extraordinary coloration efficiencies and ultra-long stability.1 Here we report the deposition of different metal complexes on surface-enhanced support and probe the ability to selectively address metal ions in these complexes to reach multiple colour-to-colour transitions within one film. We were able to sequentially switch between multiple coloured states and to demonstrate effective "colour mixing" on the surface by application of various deposition strategies. In addition, we demonstrated a successful on-surface post-modification approach to tune colours of the electrochromic monolayers and to reach desirable shades of green-coloured electrochromic materials for applications as camouflage materials.2-3 Finally, we explored the energy storage potential of our hybrid electrochromic devices and explored the role of the counter electrodes on the pathways of device degradation.4

References: 2020, *12* (37), 41749-41757. **1.** Laschuk, N. O.; Ahmad, R.; Ebralidze, I. I.; Poisson, J.; Gaspari, F.; Easton, E. B.; Zenkina, O. V., *Mater. Advances* **2021***, 2 (3), 953-962.* **2.** *Laschuk, N.O. Ebralidze, II; Easton EB, Zenkina O.V. ACS Appl. Mater. & Interfaces* ***2021,*** *13 (33), 39573-39583.* **3.** Laschuk, N. O.; Ahmad, R.; Ebralidze, I. I.; Poisson, J.; Easton, E. B.; Zenkina, O. V.. *ACS Appl. Mater. Interfaces* **4.** Ahmad, R.; Di-Palo, V..; Bell M..; Easton, E. B.; Zenkina, O. V., *ACS Energy Mater.* **2022**, 5*(4)* 3905-3914.

BIOGRAPHY - Olena Zenkina

Olena Zenkina is an expert in materials, organometallics and surface science. She studied chemical engineering at Kharkiv Polytechnic University NTU"KPI", Kharkiv, Ukraine. After graduation, she joined the group of Dr. Milko van der Boom at the Weizmann Institute of Science, Rehovot, Israel. There she was working on her Ph.D. in chemistry exploring d^{10} metals ring-walking over π-conjugated systems (2005-2010). Later she accepted a postdoctoral position in the group of Dr. Cathleen Crudden at Queen's University (2010-2014). In 2014, Dr. Zenkina accepted a position at the University of Ontario Institute of Technology (now Ontario Tech. U.) as an Assistant Professor and was promoted to Associate Professor in 2019. In 2022 she was recognized as Ontario Tech U. Research Excellence Chair in Advanced Materials. The current research interests of Dr. Zenkina are focused on the creation of a wide range of smart materials. The design of these materials starts from the simultaneous development of enhanced supports with desired morphology, chemical, mechanical, electrical properties, etc. and organic/organometallic compounds, which upon deposition on the support impart functional properties to the resulting material. She develops mild, environmentally-friendly methodologies of self-directed solution-based deposition of well-defined organic/organometallic compounds that have led to a range of functional materials with a high degree of order and structural control at the molecular level. Significant attention is paid to exploring and utilizing synergetic properties of supports and molecular coatings that induce new enhanced features to the final materials. The resulting hybrid "smart" nanomaterials were so far applied for the development of electrochromic devices, devices for energy storage, molecular- and metal ion sensors, and protein receptors. She served as an editor of the scientific chapter book "Nanomaterials Design for Sensing Applications" of the well-recognized series Micro and Nano Technologies, Elsevier, 2019.