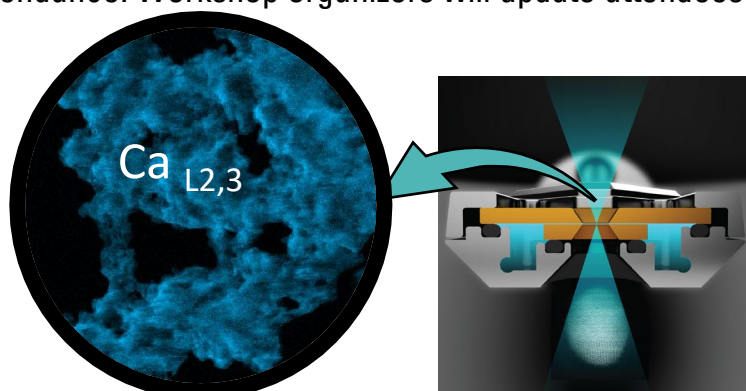
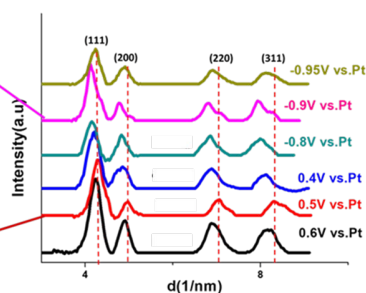
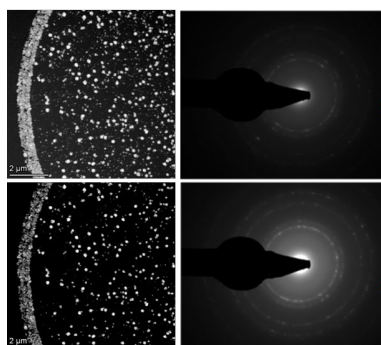


# In-situ/Operando TEM Techniques for Advanced Nanomaterial Characterization


A **TWO-DAY WORKSHOP**, on the current state and innovations in in-situ/operando transmission electron microscopy. International speakers have been invited to present their work and discuss the use of electron microscopy and spectroscopy techniques in the context of advanced nanomaterials characterization using in-situ technique. The talks are in applications ranging from sustainable energy technologies to power our future, to biological applications that will improve lives.

The workshop is scheduled as a hybrid event, such that folks who wish can attend in-person may do so following McMaster University restrictions. Depending on the state of the pandemic at the time of the workshop, it may move online for the safety of those in attendance. Workshop organizers will update attendees with the status of the event format.



## March 31 – April 1, 2022

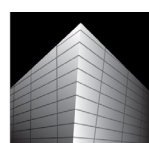
Workshop is FREE.

 REGISTER BEFORE March 17, 2022 for in-person attendance. Online registration will remain open during the event.

SUBMIT ABSTRACTS for student presentations and poster presentations by March 3, 2022 to [ccemreg@mcmaster.ca](mailto:ccemreg@mcmaster.ca). Template found at the website below.

Register at:

<https://ccem.mcmaster.ca/outreach-and-events/>



**ccem**

Canadian Centre for Electron Microscopy

McMaster  
University



### TECHNIQUES

- Electron microscopy and spectroscopic characterization under
  - Controlled gas environments
  - Liquid environments
  - Catalytic reaction conditions
  - Electrochemical potential
  - Electrical bias



### TOPICS

- Catalysis
- Electronic devices
- Sensors
- Energy technologies
- Electrochemical devices
- Building materials
- Biomedicine
- Biomaterials



### INVITED SPEAKERS

- B. Roldán Cuenya (Fritz Haber Institute)
- K. Grandfield (McMaster University)
- S. Haigh (University of Manchester)
- J. Howe (University of Toronto)
- L. Molina-Luna (TU Darmstadt)
- X. Pan (UC Irvine)
- A. Petruk (University of Waterloo)
- F. Ross (MIT DMSE)
- L. Soleymani (McMaster University)
- E. Stach (University of Pennsylvania)
- K. Unocic (ORNL)



### SCIENTIFIC ADVISOR

- D. Higgins (McMaster University/CCEM ASD)

# In-situ/Operando TEM Techniques for Advanced Nanomaterial Characterization

## Thursday March 31, 2022

9:45 EDT

### OPENING REMARKS

10:00 Modulating the properties of 2D materials through in situ electron microscopy (invited)  
**Frances Ross**, MIT DMSE

10:45 Nano-scale Characterizations of Lunar Rocks and Lab Oxides; Stories of Oxygen Migrations (invited)  
**Jane Howe**, University of Toronto

11:30

### BREAK

11:45 Operando investigation of the redox stability of bimetallic catalysts: a multimodal approach (invited)  
**Eric Stach**, University of Pennsylvania

12:30

### LUNCH

13:15 From in-situ to operando closed cell gas reaction STEM: challenges and opportunities (invited)  
**Kinga Unocic**, ORNL

14:00 In-situ & Ex-situ 3D Electron Diffraction to study Gas Reduction of  $\text{La}_x\text{Sr}_{2-x}\text{MnO}_{4-\delta}$   
**Daphne Vandemeulebroucke**, EMAT

14:30 Microchip Assemblies for High-Resolution Imaging of Human Viruses in Liquid & Cryo Conditions  
**Liza-Anastasia DiCecco**, McMaster University

15:00

### BREAK

15:15 In-situ liquid and gas phase TEM for the study of industrial nickel based catalysts (invited)  
**Savannah Turner**, Universiteit Utrecht

15:45 In-Situ Transmission Electron Microscopy Measurements of Palladium Catalysts for Understanding Heterogeneous Electrocatalytic CO<sub>2</sub> Reduction (invited)  
**Ahmed Abdellah**, McMaster University

16:15 Liquid-cell TEM studies of drop-casted specimens (invited)  
**Tyler Lott**, University of Waterloo

16:45

### RECEPTION/NETWORKING

# In-situ/Operando TEM Techniques for Advanced Nanomaterial Characterization

## Friday April 1, 2022

9:10 EDT

### OPENING REMARKS

9:15 Unveiling the Evolution of Electrocatalysts under Reaction Conditions using Electrochemical Cell Transmission Electron Microscopy and Spectroscopy (invited)

**Beatriz Roldan Cuenya**, Fritz Haber Institute

10:00 2D material heterostructure liquid cells : a platform for atomic resolution STEM imaging of adatom motion and calcium carbonate synthesis in aqueous solutions (invited)

**Sarah Haigh**, University of Manchester

10:45 Insights on Structure-Property Correlations in Metal-Insulator-Metal devices by in-situ TEM (invited)

**Leopoldo Molina-Luna**, TU Darmstadt

11:30

### BREAK

11:45 Probing the atomic scale structure, properties and dynamics of polarization states in ferroelectrics by electron microscopy (invited)

**Xiaoqing Pan**, UC Irvine

12:30

### LUNCH

13:00 In-situ gas phase electron microscopy studies on the stability of carbon supported nickel catalysts for CO<sub>2</sub> hydrogenation

**Nienke L. Visser**, Universiteit Utrecht

13:30 AXON: A TEM Software Platform to Streamline Data Analysis, Enabling a Deeper Understanding and Improved Reproducibility of Experimental Results

**David Nackashi**, Protochips

14:00 In-situ microscopy for studying biological and biomineralization events (invited)

**Kathryn Grandfield**, McMaster University

14:45 In-situ characterization of electrochemical processes using liquid cell TEM (invited)

**Leyla Soleymani**, McMaster University

15:30 Atomistic Dynamics of Disorder to Order Transitions Visualized by Computer Stabilized In Situ Electron Microscopy

**Jacob Smith**, North Carolina State University

15:50

### DAY CLOSING