Department of Applied Physics

Dr ZHU Ye

Assistant Professor

Phone Number	(852) 2766 5677
Email	ye.ap.zhu@polyu.edu.hk
Education	Ph.D. University of Wisconsin-Madison
	M.Sc. McMaster University
	B.Sc. Tsinghua University
Research Interests	Electron Microscopy and Spectroscopy, In-situ Microscopy, Energy Materials, Complex Oxides, Nano-catalysts
ORCiD	0000-0002-5217-493X
Publication	42
H-index	17
Sum of the Times Cited	2543

Awards and Honours

- Early Career Award from the Hong Kong Research Grants Council (RGC) **2017**
- International Federation of Societies for Microscopy (IFSM) Young Scientist Award **2014**
- Reviewer Award from Materials Science and Engineering B journal **2011**
- Cornell CCMR 1st Class TEM/STEM Image Award, **2011**
- 3M CTEI Award for Technical Excellence and Innovation, **2010**
- 3M Excellent Technical Contribution Award, **2009**
- Ultramicroscopy Journal Cover Image, October **2006**

Book Chapter

- **Y. Zhu** and P.M. Voyles "Nanoscale disorder in MgB_2 thin films" in MgB_2 Superconducting Wires, **2016**, World Scientific

Publications *(selected)*

- S.L. Wang, **Y. Zhu** (equal contribution first author), X. Luo, Y. Huang, J. Chai, T.I. Wong, G.Q. Xu "2D WC/WO3 heterogeneous hybrid for photocatalytic decomposition of organic compounds with vis-NIR light" Adv. Funct. Mater. 28, 1705357 (**2018**).
- **Y. Zhu***, P.N.H. Nakashima, A.M. Funston, L. Bourgeois, J. Etheridge "Topologically enclosed aluminum voids as plasmonic nanostructures" ACS Nano 11, 11383 (**2017**).
- M.U. Rothmann*, W. Li*, **Y. Zhu***(equal contribution first author), U. Bach, L. Spiccia, J. Etheridge, Y.-B. Cheng "Direct observation of intrinsic twin domains in tetragonal CH3NH3PbI3" Nature Comm. 8, 14547 (**2017**).
- W. Zhou, L. Xue, X. Lu, H. Gao, Y. Li*, S. Xin, G. Fu, Z. Cui, **Y. Zhu***, J. B. Goodenough* "NaxMV(PO4)3 (M = Mn, Fe, Ni) structure and properties for sodium extraction" Nano Lett. 16, 7836 (**2016**).
- **Y. Zhu** (corresponding), R.L. Withers, L. Bourgeois, C. Dwyer, J. Etheridge "Direct mapping of Li-enabled octahedral tilt ordering and associated strain in nanostructured perovskites" Nature Materials 14, 1142 (**2015**).
- Y. Nie*, **Y. Zhu*** (equal contribution), C.-H. Lee, L.F. Kourkoutis, J.A. Mundy, J. Junquera, Ph. Ghosez, D.J. Baek, S. Sung, X.X. Xi, K.M. Shen, D.A. Muller, D.G. Schlom "Atomically precise interfaces from non-stoichiometric deposition" Nature Comm. 5, 4530 (**2014**). (featured by Nature Materials 13, 844-845, news & views "Atoms on the move")
- C.L. Zheng, **Y. Zhu**, S. Lazar, J. Etheridge "Fast imaging with inelastically scattered electrons by off- axis chromatic confocal electron microscopy" Phys. Rev. Lett. 112, 166101 (**2014**). (Selected as a PRL Editors' Suggestion, and featured by Physics Today "A new angle on electron microscopy")
- C.-H. Lee, N.D. Orloff, T. Birol, **Y. Zhu**, V. Goian, E. Rocas, R. Haislmaier, et al. "Exploiting dimensionality and defect mitigation to create tunable microwave dielectrics" Nature 502, 532 (**2013**).

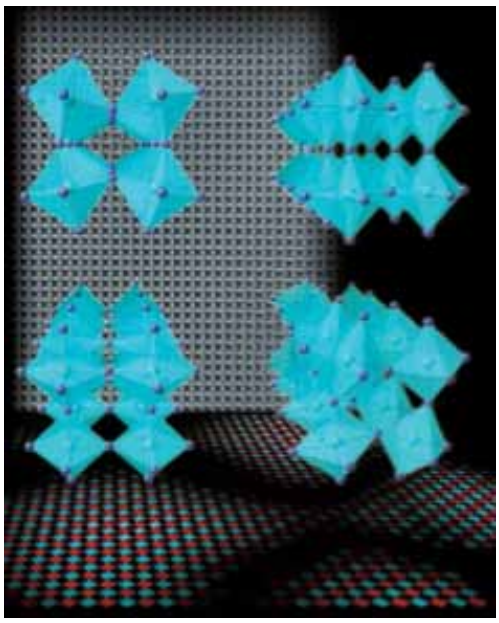
Research Overview

As an electron microscopist with a background in materials science, I use electron microscopes to understand materials at the atomic level. I dedicate my research to developing novel microscopy and spectroscopy techniques to reveal previously inaccessible information, so that we can ultimately design better materials that are stronger, faster functioning, or more energy efficient. My current research interests include:

- Scanning transmission electron microscopy and spectroscopy at atomic scale
- In-situ electron microscopy on electrochemical dynamics of energy materials
- Electron tomography reconstruction of 3D morphology of nano-catalysts

Transmission Electron Microscopy (TEM) to Reveal Atomic Structure of Complex Oxides

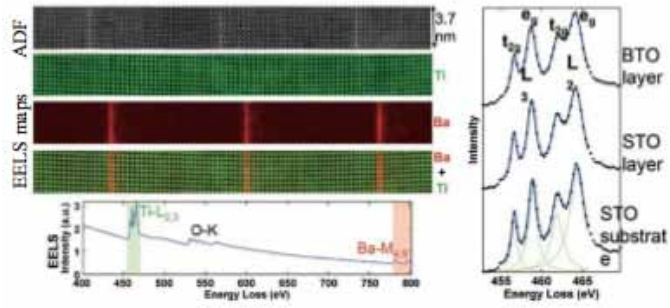
- Background: Many energy materials and catalysts are complex oxides with nanoscale disorder – difficult to be analyzed using conventional diffraction methods.
- Objective: Use aberration-corrected TEM to image disordered nanostructure with sub-Å resolution, and to understand the structure- performance correlation.
- Approaches: Sub-Å-resolution imaging with element sensitivity (such as oxygen and lithium)
- Impact: Solving the structure mystery in these materials provides more accurate input for theoretical modeling. Comparing the structure before and after cycling also reveals degradation pathways and provides guidance to improve the performance.



Nature Materi. 14, 1142 (2015)
Nature Comm. 5, 4530 (2014)
Nature 502, 532 (2013)
Appl. Phys. Lett. 102, 122901 (2013)

Atomic-level Spectroscopy to Map Local Chemical Composition and Electronic Bonding

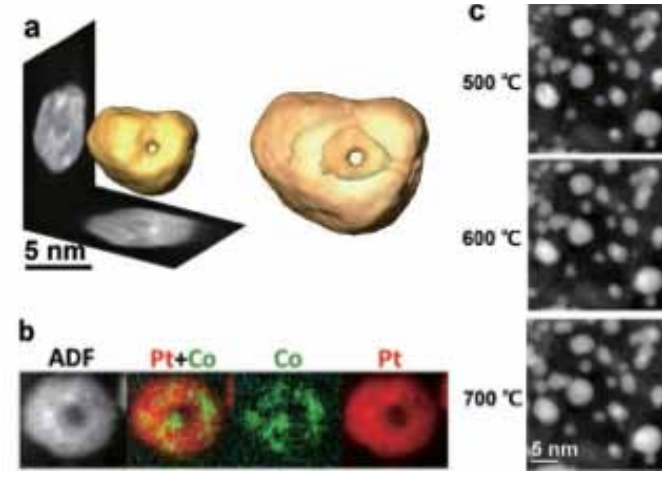
- Scanning TEM and electron energy-loss spectroscopy (EELS) provides a unique combination to probe local chemical composition as well as electronic bonding at the atomic scale. The maps on the right reveal single-layer Ba atoms embedded in $SrTiO_3$. Different Ti-O bonding, in correlation with ferroelectric distortion has also been identified.



Nature Mater. 13, 168 (2014)
Microsc. Microanal. 20, 1070 (2014)
Phys. Rev B. 90, 214305 (2014)
Nature Comm. 4, 2351 (2013)
Appl. Phys. Lett. 103, 141908 (2013)

3D Nanostructure Imaging and In-situTEM Electrochemical Characterization

- Combining EELS elemental mapping with (a) tomography can reveal both chemical and 3D structural information, which is crucial for nanostructured materials such as nano-particle catalysts and nanowires. Furthermore, structure evolution/ transformation as a function of temperature or time can also be obtained using (c) in-situ TEM.



Phys. Rev. Lett. 112, 166101 (2014)
Nature Comm. 5, 3358 (2014)
J. Electrochem. Soc. 159, F554 (2012)