Ethan Lawrence

Ph.D. Candidate, Materials Science & Engineering
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SUMMARY

Materials science & engineering (MSE) Ph.D. Candidate with four years of research experience in nanocatalyst synthesis and characterization with expertise in electron microscopy techniques seeking full time position May 2019.

EDUCATION

Ph.D., Materials Science & Engineering **2014 – Present**
Arizona State University, Tempe, AZ 3.87 GPA

B.A., Physics and Mathematics **8/2010 – 5/2014**
Coe College, Cedar Rapids, IA 3.60 GPA

TECHNICAL SKILLS

Electron Microscopy: FEI Titan Environmental-Transmission Electron Microscope (TEM)/scanning-TEM (STEM), FEI Tecnai F20, Philips CM-200, JEOL 2010F, Philips XL30 SEM, FEI Helios DualBeam SEM/FIB, FEI Nova 200 FIB

Experimental Techniques: *in situ* & environmental electron microscopy, electron energy-loss spectroscopy (EELS), energy-dispersive x-ray spectroscopy (EDX), X-ray diffraction (XRD), gas chromatography, materials synthesis, Design of Experiment (DOE), big data analysis

Software & Programming: DigitalMicrograph, Matlab, ImageJ, C++, CrystalMaker, JEMS (image simulation software), MIPAR

Other: Project Management, Microsoft Excel, Microsoft PowerPoint, Microsoft Word, Customer Service

PROFESSIONAL EXPERIENCE

Arizona State University, Tempe, AZ: Dean's Fellow Graduate Research Associate **8/2014 – Present**

- Identified strategies to reduce carbon deposition on metal-oxide nanocatalysts during hydrocarbon reforming through correlation of local structural and chemical evolution using atomic-level *in situ* imaging and spectroscopy
- Invented a technique that estimates oxygen exchange activity of reducible oxide surfaces through site-specific time-resolved atomic column tracking which can be applied to a wide range of materials problems involving interfacial transport and oxygen exchange functionalities
- Directed an engineering project to design and manufacture a custom-built TEM sample holder to permit ceramic electrolyte materials to be observed under electrochemical conditions at atomic-level
- Managed lab day-to-day operations through lab supply purchasing, equipment and software maintenance, and ensured lab safety compliance

Rockwell Collins, Cedar Rapids, IA: Graduate Technical Intern **4/2014 – 8/2014**

- Evaluated strength and electrical contact of microelectronic packaging materials
- Developed new and existing techniques for package etchant and sealant for microelectronic packaging processes

Corning, Inc., Corning, NY: Glass Research Intern **5/2013 – 8/2013**

- Optimized coloration of glass ceramic materials through dopant variation and thermal treatments to reduce costs associated with mass producing colored glasses
- Investigated phase changes of glasses to optimize optical properties for use in optoelectronic devices

ACTIVITIES

Microscopy Society of America (MSA) Pre-meeting Congress Program Chair **8/2018 – Present**

- Will oversee planning of a technical program (plenary and poster sessions, two parallel sessions), and social programming based on ~$40,000 raised from companies, institutions and individuals for the pre-meeting congress for students, postdocs, and early-career professionals at Microscopy & Microanalysis 2019

Ethan L. Lawrence

Microscopy Society of America (MSA) Student Council Co-founder **8/2016 – 8/2018**

Multiple leadership roles including Treasurer and Social Activities chair (~100 members, ~$30,000 annual budget):

- Raised $25,000 in 2017 and $39,000 in 2018 through sponsorship and donations to operate the Student Council and host a Pre-meeting Congress for students, postdocs, and early-career professionals.
- Developed a social program to engage students in professional development networking through exposure to executive leadership of the Microscopy Society of America and career mentoring from recent graduates

ASU Materials Science Graduate Student Leadership Circle, Tempe, AZ: Co-founder & Chair **1/2018 – Present**

- Created a structure for growing ASU's Materials Science & Engineering graduate student community through professional development events and social programming and raised ~$700 to fund various initiatives.

PUBLICATIONS

Oxygen Transfer at Metal-Reducible Oxide Nanocatalyst Interfaces: Contrasting Carbon Growth from Ethane and Ethylene
E. L. Lawrence & P. A. Crozier
ACS Applied Nano Materials **1** 1360-1369 (2018) DOI: 10.1021/acsanm.8b00102

Locating Active Oxygen Exchange Sites on Nanoparticle Surfaces at Atomic Resolution
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
Nature Materials (*under review*) (2018)

Real-time Imaging of Reducible Oxide Nanoparticle Surface Reconstructions using Time-resolved Aberration-corrected Transmission Electron Microscopy
E. L. Lawrence, B. D.A. Levin, B. K. Miller, P. A. Crozier
(*in preparation*) (2018)

Observing Enhanced Oxygen Exchange Activity on Locally-Strained CeO_2 Surfaces
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
(*in preparation*) (2019)

Dynamic Oxygen Exchange Rates on CeO_2 Nanoparticles: Contrasting Polar and Non-Polar Surfaces
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
(*in preparation*) (2019)

PUBLISHED CONFERENCE PROCEEDINGS

Identification of Rapid Oxygen Exchange through Site-Dependent Cationic Displacements on CeO_2 Nanoparticles
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
Microscopy and Microanalysis **24** 54-55 (2018) DOI: 10.1017/S1431927618000764

Determination of Surface Dynamics on CeO_2 Nanoparticles using Time-Resolved High-Resolution TEM
E. L. Lawrence, B. D.A. Levin, B. K. Miller, P. A. Crozier
Microscopy and Microanalysis **24** 1906-1907 (2018) DOI: 10.1017/S1431927618010012
**Best Poster Award in Physical Sciences ($250)*

***In situ* TEM Observations of Oxygen Surface Dynamics in CeO_2 Cubes**
E. L. Lawrence, S. L.Y. Chang, P. A. Crozier
Microscopy and Microanalysis **23** 1994-1995 (2017) DOI: 10.1017/S1431927617010637

***In situ* Imaging and Spectroscopy of the Carbon Deposition Mechanism on Ni/CeO_2 Solid Oxide Fuel Cell Anode Catalyst**
E. L. Lawrence & P. A. Crozier
Microscopy and Microanalysis **23** 914-915 (2017) DOI: 10.1017/S1431927617005232

***In situ* TEM Observations of Carbon Deposition on Solid Oxide Fuel Cell Anode Materials**
E. L. Lawrence & P. A. Crozier
Microscopy and Microanalysis **22** 1376-1377 (2016) DOI: 10.1017/S1431927616007728
**Best Poster Award in Physical Sciences ($250)*

Ethan L. Lawrence

Exploring the Carbon Deposition Mechanism on Ni/Gd Ceria Catalysts
E. L. Lawrence & P. A. Crozier
Microscopy and Microanalysis **21** 251-252 (2015) DOI: 10.1017/S1431927615002056
**Best Poster Award in Physical Sciences ($250)*

OTHER CONFERENCE PRESENTATIONS

Identification of Rapid Oxygen Exchange through Site-Dependent Cationic Displacements on CeO_2 Nanoparticles
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
19th International Microscopy Congress 2018, Sydney, Australia

Determination of Surface Dynamics on CeO_2 Nanoparticles using Time-Resolved High-Resolution TEM
E. L. Lawrence, B. D.A. Levin, B. K. Miller, P. A. Crozier
19th International Microscopy Congress 2018, Sydney, Australia

Atomic-Level *In situ* Imaging and Spectroscopy of Interfacial Interactions during Carbon Deposition on a Ni/CeO_2 Catalyst
E. L. Lawrence & P. A. Crozier
19th International Microscopy Congress 2018, Sydney, Australia

Atomic-Level *In situ* Imaging and Spectroscopy of Interfacial Interactions during Carbon Deposition on a Ni/CeO_2 Catalyst
E. L. Lawrence & P. A. Crozier
Materials Research Society Spring Meeting 2018

***In situ* TEM observations of Oxygen Surface Dynamics in CeO_2 Cubes**
E. L. Lawrence, B. D.A. Levin, T. Boland, S. L.Y. Chang, P. A. Crozier
Materials Research Society Spring Meeting 2018

***In situ* Imaging and Spectroscopy of Carbon Deposition on a Ni/CeO_2 Catalyst**
E. L. Lawrence & P. A. Crozier
Minerals, Metals, and Materials Society Meeting 2018

The Influence of Hydrocarbon and Catalyst Support on the Carbon Deposition onto Ni Reforming Catalysts
E. L. Lawrence & P. A. Crozier
North American Catalysis Society Meeting 2017

***In situ* Imaging and Spectroscopy of Carbon Deposition on a Ni/CeO_2 Catalyst**
E. L. Lawrence & P. A. Crozier
Materials Research Society Spring Meeting 2017

Carbon Deposition on a Ni/CeO_2 Catalyst from Hydrocarbon Gases
E. L. Lawrence & P. A. Crozier
Materials Research Society Spring Meeting 2017

***In situ* Imaging and Spectroscopy of the Carbon Deposition Mechanism on Ni/CeO_2 Solid Oxide Fuel Cell Anode Catalyst**
E. L. Lawrence & P. A. Crozier
Arizona Imaging and Microanalysis Society Conference 2017

Exploring the Carbon Deposition Mechanism on Ceria-based Catalysts
E. L. Lawrence & P. A. Crozier
Materials Research Society Spring Meeting 2016

OTHER WORK EXPERIENCE

Arizona State University, Tempe, AZ: Teaching Assistant – Electron Microscopy Lab **8/2018 – Present**

- Trained 12 graduate students as new users on Philips CM-200 TEM
- Assisted with lab development and evaluated lab reports

Ethan L. Lawrence

Arizona State University, Tempe, AZ: Undergraduate Student Mentor **2/2016 – 5/2017**

- Trained two undergraduate researchers on materials synthesis and basic characterization of nanoparticles
- Guided these students through research grant proposal writing, resulting in four Fulton Undergraduate Research Initiative Awards (FURI)

University of Manitoba, Winnipeg, Manitoba, Canada: Glass Research Intern **5/2012 – 8/2012**

- Investigated short-range order of vanadium-based glasses through nuclear magnetic resonance (NMR)

Coe College, Cedar Rapids, IA: Glass Research Intern **5/2011 – 8/2011**

- Characterized vanadium-based glass properties through differential scanning calorimetry (DSC) to correlate the effect of composition on phase transitions

AWARDS & RECOGNITION

Best Poster Award - Microscopy & Microanalysis 2018

Kokes Award - North American Catalysis Society Meeting 2017

Bruker Best Poster Award - Arizona Imaging and Microanalysis Society Conference 2017

Best Poster Award - Microscopy & Microanalysis 2016

Best Poster Award - Microscopy & Microanalysis 2015

Dean's Fellowship - Graduate College, Arizona State University, 2014 - 2018

Featured Undergraduate Researcher - Society of Physics Students (SPS) Observer Magazine Spring 2015 issue

Sponsored Participant, ASU Winter School on High Resolution Electron Microscopy – Eyring Materials Center

Presidential Scholarship - Coe College

SERVICE & MENTORSHIP

Microscopy Society of America (MSA) Pre-meeting Congress Co-Organizer **8/2017 – 8/2018**

- Co-organized a pre-meeting congress for Practical Challenges and Opportunities for *in situ*/*operando* Microscopy in Liquids and Gases at Microscopy and Microanalysis 2018

Lab Assistant, ASU Winter School on High Resolution Electron Microscopy **2015 – Present**

- Demonstrated electron microscopy techniques to school participants

North American Ambassador, 19th International Microscopy Congress **2017 – 2018**

Symposia Assistant, Microscopy & Microanalysis / Materials Research Society **2016**

Regional Tournament Volunteer, Arizona FIRST LEGO League **2015 – 2016**

Sigma Pi Sigma Inductee, U.S. Physics Honor Society **2014**

Science is Fun Mentor, Coe College **2010 – 2014**

REFERENCES

Prof. Peter Crozier Crozier@asu.edu
Prof. David Smith David.Smith@asu.edu
Prof. Jingyue Liu Jingyue.Liu@asu.edu