

Curriculum Vitae and List of Publications

Alexandre Foucher

Mobile: 713 540 8890 Email: foucherac@ornl.gov

Work address

Oak Ridge National Laboratory
1 Bethel Valley Rd, Bldg. 4515, Rm. 209
Oak Ridge, TN 37831

Research interests

Aberration-corrected (scanning) transmission electron microscopy ((S)TEM), electron energy loss spectroscopy (EELS) , *in situ* gas-heating / liquid / biasing experiments, materials for catalysis, fuel cells and batteries, semiconductors and 2D materials, electron pair-distribution function (ePDF) analysis, focused-ion beam (FIB) sample preparation, X-ray absorption spectroscopy (XAS).

Appointments

2022- present: Postdoctoral Associate, Massachusetts Institute of Technology, Department of Materials Science and Engineering. Advisor: Prof. Frances M. Ross.

Skills: *In situ* (S)TEM, FIB sample preparation, EELS, 4D STEM.

Tasks: Understanding semiconductors and memory devices at the atomic scale (changes in phase, composition, oxidation level) using *in situ* biasing and *in situ* gas-heating STEM. Development of new *in situ* (S)TEM experiments.

2017-2022: Ph.D. student, University of Pennsylvania, Department of Materials Science and Engineering. Advisor: Prof. Eric A. Stach. My project was part of an Energy Frontier Research Center (EFRC).

Skills: *Ex situ* and *in situ* (S)TEM, EELS, XAS, multimodal STEM/XAS analysis, ePDF, diffraction.

Tasks: Understanding changes in composition and valence state in nanocatalysts (among others CoPt, CuIr, and CuPt nanoparticles for fuel cells) with *in situ* gas-heating STEM. Enhancing TEM diffraction, EELS capabilities and multimodal characterization with XAS, machine learning analysis of STEM and EELS data.

Education

Ph.D. in Materials Science and Engineering, University of Pennsylvania, Philadelphia, PA. Defense: February 28th, 2022. **2017-2022.**

Dissertation: *Ex situ* and *in situ* transmission electron microscopy analysis of bimetallic nanocatalysts. Doctoral advisor: Pr. Eric A. Stach. Committee: Christopher B. Murray, Raymond J. Gorte, Peter K. Davies.

Master of Materials Science and Nanoengineering, Rice University, Houston, TX, **2016-2017.**

Combined BS/MS in Mechanical and Industrial Engineering at Arts et Métiers ParisTech Graduate School of Mechanical and Industrial Engineering (Ecole Nationale Supérieure d'Arts et Métiers), Paris, France, **2011-2016.**

Work experience in companies

June 2016 - August 2016: Intern at the Materials Science Laboratory of the Sony Technology Center (**Sony Corporation**) in Stuttgart, Germany. Supervisor: Dr. Gabriele Nelles and Dr. Nadejda Krasteva.

Tasks: Tested and prepared active materials for enhancement of Li-ion battery stability at high-voltage charging. The goal was to design and understand novel Li-ion battery with enhanced energy storage capacity.

Publications (Citation > 2500, h-index: 18). Total of 59 publications. 14 first-author papers published, including two first-author papers in JACS and two first-author papers in Chemistry of Materials. 1 book chapter for Springer Handbook.

Google scholar: <https://scholar.google.com/citations?hl=en&user=7EbcqtUAAAAJ>

First author publications

- (13) **Foucher, A.C.**; Mortelmans, W.; Reidy, K.; Frenkel, A.I.; Sofer, Z., Jaramillo, R.; Ross, F.M. In situ investigation of structural changes in HfSe₂ and ZrSe₂ 2D films in redox conditions, *Journal of Materials Chemistry C*, **2024**, 12, 9677-9684.
- (12) **Foucher, A.C.**; Ngan, H.T.; Shirman, T.; Filie, A.; Duanmu, K.; Aizenberg, M.; Aizenberg, J.; Madix, R. J.; Sautet, P.; Stach, E.A. Optimization of Pd in Au-Pd nanoparticles for the hydrogenation of alkynes, *ACS Appl. Nano Mater.* **2023**, 6, 22927-22938.
- (11) **Foucher, A.C.**; Stach, E.A.; Identifying Dynamic Restructuring Effects in Nanocatalysts by Combining In situ Scanning Transmission Electron Microscopy and In situ X-ray Absorption Spectroscopy: A Review, *Catalysis Today*, **2024**, 428, 114417.
- (10) **Foucher, A.C.**; Rosen D.J.; Decker L.K.; Macfarlane R.J.; Stach, E.A.; Ross, F.M.; Structure and stability of core-shell Cu-Pt nanoparticles for catalytic applications, *Chemistry of Materials*. **2023**, 35, 8758-8764.
- (9) **Foucher, A.C.**; Yang, S.; Rosen, D.J.; Sanchez, D. F.; Sadykov, I.; Grolimund, D.; Kozinsky, B.; Gorte, R. J.; Frenkel, A.I.; Murray, C.B.; Stach, E.A.; Stable and efficient Ir nanoshells for oxygen reduction and evolution reactions, *Chem. Mat.* **2023**, 35, 4572-4580.
- (8) **Foucher, A.C.**; Yang, S.; Rosen, D.J.; Huang, R.; Pyo, J.B., Kwon, O.; Owen, C.J.; Sanchez, D. F.; Sadykov, I.; Grolimund, D.; Kozinsky, B.; Gorte, R. J.; Frenkel, A.I.; Murray, C.B.; Stach, E.A.; Synthesis and Characterization of Stable Cu-Pt Nanoparticles under Reductive and Oxidative Conditions, *J. Am. Chem. Soc.* **2023**, 145, 5410-5421.
- (7) **Foucher, A.C.**; Lee, J.D.; Qi, Z. ; Li, G. ; Ouyang, G. ; Cui, J. ; Boscoboinik, J.A. ; Friend, C.M., Stach, E.A.; Boosting the H₂-D₂ exchange activity of dilute nanoporous Ti-Cu catalysts through oxidation-reduction cycle induced restructuring, *Advanced Engineering Materials* **2023**, 2201724.
- (6) **Foucher, A. C.**; Owen, C. J.; Shirman, T.; Aizenberg, J.; Kozinsky, B.; Stach, E. A. Atomic-Scale STEM Analysis Shows Structural Changes of Au-Pd Nanoparticles in Various Gaseous Environments. *J. Phys. Chem. C* **2022**, 126, 18047–18056.
- (5) **Foucher, A. C.**; Yang, S.; Rosen, D. J.; Lee, J. D.; Huang, R.; Jiang, Z.; Barrera, F. G.; Chen, K.; Hollyer, G. G.; Friend, C. M.; Gorte, R. J.; Murray, C. B.; Stach, E. A. Synthesis and

- Characterization of Core-Shell Cu-Ru, Cu-Rh, and Cu-Ir Nanoparticles. *J. Am. Chem. Soc.* **2022**, *144*, 7919–7928.
- (4) **Foucher, A. C.**; Han, M.; Shuck, C. E.; Maleski, K.; Gogotsi, Y.; Stach, E. A. Shifts in Valence States in Bimetallic MXenes Revealed by Electron Energy-Loss Spectroscopy (EELS). *2D Mater.* **2022**, *9*, 025004.
 - (3) **Foucher, A. C.**; Marcella, N.; Lee, J. D.; Tappero, R.; Murray, C. B.; Frenkel, A. I.; Stach, E. A. Dynamical Change of Valence States and Structure in NiCu₃ Nanoparticles during Redox Cycling. *J. Phys. Chem. C* **2022**, *126*, 1991–2002.
 - (2) **Foucher, A. C.**; Marcella, N.; Lee, J. D.; Rosen, D. J.; Tappero, R.; Murray, C. B.; Frenkel, A. I.; Stach, E. A. Structural and Valence State Modification of Cobalt in CoPt Nanocatalysts in Redox Conditions. *ACS Nano* **2021**, *15*, 20619-20632.
 - (1) **Foucher, A.C.**; Stach, E.A.; High Pressure Transmission Electron Microscopy (TEM), *Springer Handbook for Advanced Catalyst Characterization*, **2023**, **Book Chapter**, 381-407, Springer Nature Switzerland AG, Cham, Springer International.

Other publications

- (46) Crandall B.S., Qi Z., **Foucher A.C.** et al. Cu Based Dilute Alloys for Tuning the C₂⁺ Selectivity of Electrochemical CO₂ Reduction, *Small*, **2024**, 2401656.
- (45) Park E., Philbin J.P., Chi H., Sanchez J.J., Ochialini S.C., Varnavides G., Curtis J.B., Song Z., Klein J., Thomsen J.D., Han M., **Foucher A.C.** et al. Anisotropic 2D van der Waals Magnets Hosting 1D Spin Chains, *Adv. Mater.*, **2024**, *36*, 2401534
- (44) Thomsen J.D., Han M., Penn A.N., **Foucher A.C.** et al. Effect of Surface Oxidation and Crystal Thickness on the Magnetic Properties and Magnetic Domain Structures of Cr₂Ge₂Te₆, *ACS Nano*, **2024**, *18*, 13458-13467.
- (43) S Han, JS Kim, E Park, Y Meng, Z Xu, **Foucher A.C.** et al. High energy density in artificial heterostructures through relaxation time modulation, *Science*, *384*, 312-317, **2024**.
- (42) Xie M.; Shimogawa R.; Liu Y.; Zhang L.; **Foucher A.C.** Biomimetic Control over Bimetallic Nanoparticle Structure and Activity via Peptide Capping Ligand Sequence, *ACS Nano*. **2024**, *18*, 3286-3294.
- (41) Pu T., Setiawan A., **Foucher A.C.** et al. Revealing the Nature of Active Oxygen Species and Reaction Mechanism of Ethylene Epoxidation by Supported Ag/ α -Al₂O₃ Catalysts, *ACS Catal.* *14*, 406-417, **2024**.
- (40) Li M., Qi T., Welborn S., **Foucher A.C.**; et al. Understanding the fast kinetics and mechanism of sodium storage in antimony using ab initio grand canonical Monte Carlo simulation and operando X-ray scattering, *J Mater. Chem.* **2024**, *12*, 3671-3681.
- (39) Reidy, K.; Mortelmans, W.; Jo, SS; Penn, AN, **Foucher A.C.**; et al .Atomic-Scale Mechanisms of MoS₂ Oxidation for Kinetic Control of MoS₂/MoO₃ Interfaces, *Nano Lett.* **2023**, *23*, 13, 5894–5901
- (38) Chi, H. Ou, Y.; Eldred, TB.; Gao, W.; Kwon, S.; Murray, J.; Dreyer, M.; Butera, RE, **Foucher A.C.**; et al. Strain-tunable Berry curvature in quasi-two-dimensional chromium telluride, *Nature Communications* **2023**, *14*, 3222.
- (37) Marchi M., Raciti E., Manoj Gali S., Piccirilli F., Vondracek H., Actis A., Salvadori E., Rosso C.,

- Criado A., D'Agostini C., Forster L., Lee D., Foucher A.C. et al. Carbon Vacancies Steer the Activity in Dual Ni Carbon Nitride Photocatalysis, *Adv. Sci.* **2023**, 2303781
- (36) Gong, Q. et al. Amino-tethering synthesis strategy toward highly accessible sub-3-nm L10-PtM catalysts for high-power fuel cells, *Matter* **2023**, 6, 963-982
- (35) Longo, T.; Kim, S.; Srivastava, A.K.; Hurley, L.; Viescas, A. J.; Flint, N.; **Foucher A.C.**; Yates, D., Stach, E.A.; Bou-Abdallah, F.; Papaefthymiou, G. C.; Micromagnetic and morphological characterization of heteropolymer human ferritin cores. *Nanoscale Adv.*, **2023**, 5, 208-211.
- (34) Qi, Z.; Kashi, A. R.; Buckley, A. K.; Miller, J. S.; Ye, J.; Biener, M. M.; **Foucher, A. C.**; Stach, E. A.; Ma, S.; Kuhl, K. P.; Biener, J. Effect of Gold Catalyst Surface Morphology on Wetting Behavior and Electrochemical CO₂ Reduction Performance in a Large-Area Zero-Gap Gas Diffusion Electrolyzer. *J. Phys. Chem. C* **2022**, 126, 19637–19646.
- (33) Han, M.; Shuck, C. E.; Singh, A.; Yang, Y.; **Foucher, A. C.**; Goad, A.; McBride, B.; May, S. J.; Shenoy, V. B.; Stach, E. A.; Gogotsi, Y. Efficient Microwave Absorption with V_{n+1}C_nT_x MXenes. *Cell Reports Phys. Sci.* **2022**, 3, 101073.
- (32) Reutovich, A. A.; Srivastava, A. K.; Smith, G. L.; **Foucher, A. C.**; Yates, D. M.; Stach, E. A.; Papaefthymiou, G. C.; Arosio, P.; Bou-Abdallah, F. Effect of Phosphate and Ferritin Subunit Composition on the Kinetics, Structure, and Reactivity of the Iron Core in Human Homo- and Heteropolymer Ferritins. *Biochemistry* **2022**, 61, 2106–2117.
- (31) Lee, J. D.; Qi, Z.; **Foucher, A. C.**; Tong Ngan, H.; Dennis, K.; Cui, J.; Sadykov, I. I.; Crumlin, E. J.; Sautet, P.; Stach, E. A.; Friend, C. M.; Madix, R. J.; Biener, J. Facilitating Hydrogen Dissociation over Dilute Nanoporous Ti-Cu Catalysts. **2022**. *J. Am. Chem. Soc.*, 37, 16778–16791.
- (30) Liu, Y.; Xie, M.; Marcella, N.; **Foucher, A. C.**; Stach, E. A.; Knecht, M. R.; Frenkel, A. I. Z-Contrast Enhancement in Au-Pt Nanocatalysts by Correlative X-Ray Absorption Spectroscopy and Electron Microscopy: Implications for Composition Determination. *ACS Appl. Nano Mater.* **2022**, 5, 8775–8782.
- (29) Rosen, D. J.; **Foucher, A. C.**; Lee, J. D.; Yang, S.; Marino, E.; Stach, E. A.; Murray, C. B. Microwave Heating of Nanocrystals for Rapid, Low-Aggregation Intermetallic Phase Transformations. *ACS Mater. Lett.* **2022**, 4, 823–830.
- (28) Lee, J. D.; Miller, J. B.; Shneidman, A. V.; Sun, L.; Weaver, J. F.; Aizenberg, J.; Biener, J.; Boscoboinik, J. A.; **Foucher, A. C.**; Frenkel, A. I.; et al. Dilute Alloys Based on Au, Ag, or Cu for Efficient Catalysis: From Synthesis to Active Sites. *Chem. Rev.* **2021**.
- (27) Kwon, O.; Foucher, A. C.; Huang, R.; Stach, E. A.; Vohs, J. M.; Gorte, R. J. Evidence for Redispersion of Ni on LaMnO₃ Films Following High-Temperature Oxidation. *J. Catal.* **2022**, 407, 213–220.
- (26) Marcella, N.; Lim, J. S.; Plonka, A. M.; Yan, G.; Owen, C. J.; van der Hoeven, J. E. S.; **Foucher, A. C.**; Ngan, H. T.; Torrisi, S. B.; Marinkovic, N. S.; Stach, E. A.; Weaver, J. F.; Aizenberg, J.; Sautet, P.; Kozinsky, B.; Frenkel, A. I. Decoding Reactive Structures in Dilute Alloy Catalysts. *Nat. Commun.* **2022**, 13, 1–9.
- (25) Srivastava, A. K.; Hurley, L.; Ji, K.; Viescas, A. J.; Flint, N.; **Foucher, A.C.**; Yates, D. M.; Stach, E. A.; Bou-Abdallah, F.; Papaefthymiou, G. C.; Longo, T.; Kim, S.; et al. Micromagnetic and Morphological Characterization of Heteropolymer Human Ferritin Cores. *Nanoscale Adv.* **2022**.
- (24) Wang, Y.; Lee, S.; Zhou, J.; Fu, J.; **Foucher, A.C.**; Stach, E.; Ma, L.; Marinkovic, N.; Ehrlich, S.; Zheng, W.; Vlachos, D. G. Higher Loadings of Pt Single Atoms and Clusters over Reducible

Metal Oxides: Application to C–O Bond Activation. *Catal. Sci. Technol.* **2022**, *12*, 2920–2928.

- (23) Filie, A.; Shirman, T.; **Foucher, A. C.**; Stach, E. A.; Aizenberg, M.; Aizenberg, J.; Friend, C. M.; Madix, R. J. Dilute Pd-in-Au Alloy RCT-SiO₂ Catalysts for Enhanced Oxidative Methanol Coupling. *J. Catal.* **2021**, *404*, 943–953.
- (22) Serra-Maia, R.; Kumar, P.; Meng, A. C.; **Foucher, A. C.**; Kang, Y.; Karki, K.; Jariwala, D.; Stach, E. A. Nanoscale Chemical and Structural Analysis during in Situ Scanning/Transmission Electron Microscopy in Liquids. *ACS Nano* **2021**, *15*, 10228–10240.
- (21) Kumar, P.; Figueroa, K. S.; **Foucher, A. C.**; Jo, K.; Acero, N.; Stach, E. A.; Jariwala, D. Efficacy of Boron Nitride Encapsulation against Plasma-Processing of 2D Semiconductor Layers. *J. Vac. Sci. Technol. A Vacuum, Surfaces, Film.* **2021**, *39*, 032201.
- (20) Mathis, T. S.; Maleski, K.; Goad, A.; Sarycheva, A.; Anayee, M.; **Foucher, A. C.**; Hantanasirisakul, K.; Shuck, C. E.; Stach, E. A.; Gogotsi, Y. Modified MAX Phase Synthesis for Environmentally Stable and Highly Conductive Ti₃C₂ MXene. *ACS Nano* **2021**, *15*, 6420–6429.
- (19) Wang, M.; Meng, A. C.; Fu, J.; **Foucher, A. C.**; Serra-Maia, R.; Stach, E. A.; Detsi, E.; Pikul, J. H. Surface Facet Engineering in Nanoporous Gold for Low-Loading Catalysts in Aluminum-Air Batteries. *ACS Appl. Mater. Interfaces* **2021**, *13*, 13097–13105.
- (18) Meng, A. C.; Low, K. Bin; **Foucher, A. C.**; Li, Y.; Petrovic, I.; Stach, E. A. Anomalous Metal Vaporization from Pt/Pd/Al₂O₃ under Redox Conditions. *Nanoscale* **2021**, *13*, 11427–11438.
- (17) Zhou, Y.; Yu, Y.; Ma, D.; **Foucher, A. C.**; Xiong, L.; Zhang, J.; Stach, E. A.; Yue, Q.; Kang, Y. Atomic Fe Dispersed Hierarchical Mesoporous Fe-N-C Nanostructures for an Efficient Oxygen Reduction Reaction. *ACS Catal.* **2021**, *11*, 74–81. G.
- (16) Li, M.; Qiu, T.; **Foucher, A. C.**; Fu, J.; Wang, Z.; Zhang, D.; Rappe, A. M.; Stach, E. A.; Detsi, E. Impact of Hierarchical Nanoporous Architectures on Sodium Storage in Antimony-Based Sodium-Ion Battery Anodes. *ACS Appl. Energy Mater.* **2020**, *3*, 11231–11241.
- (15) Wang, D.; Zheng, J.; Musavigharavi, P.; Zhu, W.; **Foucher, A. C.**; Trolier-Mckinstry, S. E.; Stach, E. A.; Olsson, R. H. Ferroelectric Switching in Sub-20 Nm Aluminum Scandium Nitride Thin Films. *IEEE Electron Device Lett.* **2020**, *41*, 1774–1777.
- (14) Han, M.; Maleski, K.; Shuck, C. E.; Yang, Y.; Glazar, J. T.; **Foucher, A. C.**; Hantanasirisakul, K.; Sarycheva, A.; Frey, N. C.; May, S. J.; Shenoy, V. B.; Stach, E. A.; Gogotsi, Y. Tailoring Electronic and Optical Properties of MXenes through Forming Solid Solutions. *J. Am. Chem. Soc.* **2020**, *142*, 19110–19118.
- (13) Kumar, P.; Horwath, J. P.; **Foucher, A. C.**; Price, C. C.; Acero, N.; Shenoy, V. B.; Stach, E. A.; Jariwala, D. Direct Visualization of Out-of-Equilibrium Structural Transformations in Atomically Thin Chalcogenides. *npj 2D Mater. Appl.* **2020**, *4*, 1–10.
- (12) Mao, X.; **Foucher, A. C.**; Montini, T.; Stach, E. A.; Fornasiero, P.; Gorte, R. J. Epitaxial and Strong Support Interactions between Pt and LaFeO₃ Films Stabilize Pt Dispersion. *J. Am. Chem. Soc.* **2020**, *142*, 10373–10382.
- (11) Bertella, F.; Bertella, F.; Lopes, C. W.; **Foucher, A. C.**; Agostini, G.; Concepción, P.; Stach, E. A.; Martínez, A. Insights into the Promotion with Ru of Co/TiO₂ Fischer-Tropsch Catalysts: An in Situ Spectroscopic Study. *ACS Catal.* **2020**, *10*, 6042–6057.
- (10) Luneau, M.; Guan, E.; Chen, W.; **Foucher, A. C.**; Marcella, N.; Shirman, T.; Verbart, D. M. A.; Aizenberg, J.; Aizenberg, M.; Stach, E. A.; Madix, R. J.; Frenkel, A. I.; Friend, C. M. Enhancing

Catalytic Performance of Dilute Metal Alloy Nanomaterials. *Commun. Chem.* **2020**, *3*, 1–9.

- (9) Guan, E.; **Foucher, A. C.**; Marcella, N.; Shirman, T.; Luneau, M.; Head, A. R.; Verbart, D. M. A.; Aizenberg, J.; Friend, C. M.; Stacchiola, D.; Stach, E. A.; Frenkel, A. I. New Role of Pd Hydride as a Sensor of Surface Pd Distributions in Pd–Au Catalysts. *ChemCatChem* **2020**, *12*, 717–721.
- (8) Lin, C.; **Foucher, A. C.**; Ji, Y.; Stach, E. A.; Gorte, R. J. Investigation of Rh–Titanate (ATiO₃) Interactions on High-Surface-Area Perovskite Thin Films Prepared by Atomic Layer Deposition. *J. Mater. Chem. A* **2020**, *8*, 16973–16984.
- (7) Mao, X.; **Foucher, A. C.**; Stach, E. A.; Gorte, R. J. Changes in Ni–NiO Equilibrium Due to LaFeO₃ and the Effect on Dry Reforming of CH₄. *J. Catal.* **2020**, *381*, 561–569.
- (6) Deysher, G.; Shuck, C. E.; Hantanasirisakul, K.; Frey, N. C.; **Foucher, A. C.**; Maleski, K.; Sarycheva, A.; Shenoy, V. B.; Stach, E. A.; Anasori, B.; Gogotsi, Y. Synthesis of Mo₄VAlC₄ MAX Phase and Two-Dimensional Mo₄VC₄ MXene with Five Atomic Layers of Transition Metals. *ACS Nano* **2020**, *14*, 204–217.
- (5) Luneau, M.; Shirman, T.; **Foucher, A. C.**; Duanmu, K.; Verbart, D. M. A.; Sautet, P.; Stach, E. A.; Aizenberg, J.; Madix, R. J.; Friend, C. M. Achieving High Selectivity for Alkyne Hydrogenation at High Conversions with Compositionally Optimized PdAu Nanoparticle Catalysts in Raspberry Colloid-Templated SiO₂. *ACS Catal.* **2020**, *10*, 441–450.
- (4) Lin, C.; **Foucher, A. C.**; Ji, Y.; Curran, C. D.; Stach, E. A.; McIntosh, S.; Gorte, R. J. “intelligent” Pt Catalysts Studied on High-Surface-Area CaTiO₃ Films. *ACS Catal.* **2019**, *9*, 7318–7327.
- (3) Mao, X.; **Foucher, A. C.**; Stach, E. A.; Gorte, R. J. “Intelligent” Pt Catalysts Based on Thin LaCoO₃ Films Prepared by Atomic Layer Deposition. *Inorganics* **2019**, Vol. 7, Page 113 **2019**, *7*, 113.
- (2) Pepin, P. A.; Lee, J. D.; **Foucher, A. C.**; Murray, C. B.; Stach, E. A.; Vohs, J. M. The Influence of Surface Platinum Deposits on the Photocatalytic Activity of Anatase TiO₂ Nanocrystals. *J. Phys. Chem. C* **2019**, *123*, 10477–10486.
- (1) Mao, X.; **Foucher, A. C.**; Stach, E. A.; Gorte, R. J. A Study of Support Effects for CH₄ and CO Oxidation over Pd Catalysts on ALD-Modified Al₂O₃. *Catal. Letters* **2019**, *149*, 905–915.

First author publications under review or in preparation

- (2) **Foucher, A.C.**; Mortelmans, W.; Reidy, K.; Frenkel, A.I.; Sofer, Z., Jaramillo, R.; Ross, F.M. Investigation of oxidation mechanisms in HfS₂ and ZrS₂ 2D films with *in situ* microscopy, **under review**, *Journal of Materials Chemistry C*, **(postdoctoral project)**.
- (1) **Foucher, A.C.**; Wang, B.; Ando, T.; Rozen, J.; Ross, F.M. In situ STEM characterization of Structural changes in HfO₂ for neuromorphic devices, **in preparation (postdoctoral project)**.

Collaborations with companies

Intel, IBM, BASF, and Sony Corporation

Honors and Awards

July 2019 - June 2020: Graduate Student Fellow of the Vagelos Institute for Energy Science and Technology, University of Pennsylvania: The fellowship is “awarded on the basis of academic excellence, that demonstrated likelihood that the Fellow will become a leader in the next generation of energy scientists and engineers, and alignment of the Ph. D. project with the research priorities of the Institute”.

June 2016: Winner of the Mayoux-Dauriac Price, which awards fourth-year students for “their knowledge of the French language and their use in oral report and writings in literary, mathematical or scientific works”. 8 winners out of 1263 students.

Internship

February 2016 - May 2016: Research Assistant at the Materials Science laboratory of Arts et Métiers ParisTech, PIMM: Processes and Engineering in Mechanics and Materials, within the Comet group, in parallel to my studies. Research supervisor: Dr. Véronique Favier.

Tasks: Conducted conventional and ultrasonic fatigue testing on metallic samples: The goal was to understand degradation mechanisms of materials used in industry.

Teaching

Fall 2023: Teaching Assistant for Course 3.22: “Structure and Mechanics of Materials”, a core course for graduate students taught by Pr. Frances M. Ross, **MIT**.

Fall 2021: Teaching Assistant for MSE 530: “Thermodynamics of materials”, a core course for MSE graduate students taught by Pr. I-Wei Chen, **University of Pennsylvania**. Evaluation: **4/4**.

I also worked with four senior undergraduate students on a “senior design project”. We are synthesizing novel bimetallic samples to optimize the use of precious metals such as Ir, Ru or Rh.

Spring 2021: Teaching Assistant for MSE 520: “Structure of Materials”, a core course for MSE graduate students taught by Pr. I-Wei Chen, **University of Pennsylvania**. Evaluation: **3.71/4**.

Fall 2020: Teaching Assistant for MSE 530: “Thermodynamics of materials”, a core course for MSE graduate students taught by Pr. I-Wei Chen, **University of Pennsylvania**. Evaluation: **3.80/4**.

Spring 2020: Teaching Assistant for MSE 520: “Structure of Materials”, a core course for MSE graduate students taught by Pr. I-Wei Chen, **University of Pennsylvania**. Evaluation: **3.62/4**.

Applications for grants and funding sources

Co-writer of proposals and proposal renewals for projects funded by the semiconductor research society (SRC) and IBM.

Conferences

M&M 2024: Oral presentation: (invited talk): “Multimodal STEM and XAS Characterization of Bimetallic Nanocatalysts”.

MRS Fall 2023: Oral presentation (in person): Dynamic Changes in Intermetallic CuPt Catalysts Studied with In Situ Gas-Heating STEM-EELS Analysis at 1 Bar.

Oral presentation (in person): Surface Dynamics of Hf- and Zr- based Thin Films During Oxidation Studied with In Situ STEM and SEM to Guide the Design of Innovative Electronic Devices.

Oral presentation (in person): Filament-Induced Crystallization of TiN/HfO_x/TiN Film in Neuromorphic Devices.

NAM 2023: Oral presentation (in person): “Synthesis and Characterization of core-shell Cu-Ru, Cu-Rh and Cu-Ir nanoparticles”.

MRS Spring 2023: Oral presentation (in person): “Synthesis and Characterization of Pt and Pd Nano-Shells to Optimize the Performance and Reduce the Cost of Expensive Catalysts”.

MRS Fall 2022: Oral presentation (in person):

“Effects of Crystallization on the Conductance of HfO_x ReRAM by In Situ TEM Method”.

“Investigation of Oxidation Mechanism in HfS₂ and ZrS₂ TMDs with In Situ Transmission Electron Microscopy”.

MRS Fall 2021: Poster presentation: “Synthesis and Characterization of Core-Shell Cu-Ru, Cu-Rh, and Cu-Ir Nanoparticles”.

M&M 2021: Oral presentation: (virtual): “Structural and Valence State Modification of Cobalt in CoPt Nanocatalysts in Redox Conditions”.

MRS Spring 2021: Oral presentation (virtual): “Structural and Valence State Modification of Cobalt in CoPt Nanocatalysts in Redox Conditions”.

Professional Service

Referee for ACS Applied Materials & Interfaces

Member of the Microscopy Society of America (MSA) Education Outreach Committee.

Languages: French (native), German (bilingual), English (fluent).