Lok-kun Tsui

Research Assistant Professor, University of New Mexico, Center for Micro-Engineered Materials
505-925-5987 | lktsui@unm.edu | 1001 University Blvd, Albuquerque, NM, 87106

EDUCATION

University of Virginia, Charlottesville, VA

- Ph.D., Materials Science and Engineering — August 2015
- Master of Science, Materials Science and Engineering — May 2011
- GPA: 4.0/4.0

James Madison University, Harrisonburg, VA

- Bachelor of Science (Summa Cum Laude), Physics with Minor in Mathematics — May 2009
- Class of 2009 Valedictorian
- GPA: 4.0/4.0

EXPERIENCE

Research Assistant Professor (University of New Mexico, Center for Micro-Engineered Materials) Dec. 2017 – Present

- Performing additive manufacturing of electrochemical devices including silver iodide and silver iodide – alumina components to produce resistive switching devices for satellite electronics.
- Performing additive manufacturing of high density ceramic structures and characterizing the influence of printing parameters on microstructure and density.
- Developed force sensing capability on an extrusion printer to monitor rheological properties of UV-curable pastes.
- Mentor for Air Force Research Laboratory summer scholars internship program.

Postdoctoral Fellow (University of New Mexico, Center for Micro-Engineered Materials) Oct. 2015 – Nov. 2017

- Developing ceramic mixed-potential solid-state electrochemical gas sensors for detecting pollutants in automotive exhaust gases and techniques to monitor sensor durability and reproducibility. Producing devices using additive manufacturing and evaluating their performance and variability of materials characteristics.
- Wrote control software for gas mixing, sensor temperature control, and signal acquisition with LabVIEW.
- Developed and wrote documentation for CarbonXS GUI, a free open-source graphical interface for the XRD analysis software CarbonXS. Available online at http://github.com/lktsui/carbon_xs_gui
- Applying machine learning algorithms including artificial neural networks to extract concentrations from sensor signals and identify gas mixtures.

Graduate Research Assistant (University of Virginia, Materials Science and Engineering) Aug. 2009 – Aug. 2015

- Developed photoelectrochemical solar cells with TiO_2 nanotubes for generation of hydrogen from sunlight by correlating synthesis conditions with electronic and electrochemical properties and enhancing efficiency with doping processes.
- Programmed control software for an electrochemical power supply and current meter, salt solution inkjet printer, and humidity controller using LabVIEW, and wrote Python scripts to automate data analysis.

Undergraduate Research (James Madison University, Physics) Feb. 2007 – Aug. 2009

- Developed a process using electron beam lithography and electron beam evaporation for patterning metal contacts with nanoscale accuracy to study the mechanical properties of carbon nanotubes when twisted.

SKILLS

- **Software**: CorrWare, EC-Lab, OriginPro, MathCAD, Minitab, Maple, Eclipse Pydev, PyCharm, Mercurial, Git, Slic3r, Cura, Autodesk Fusion 360, FreeCAD.
- **Programming Languages**: Python, LabVIEW, MATLAB, C.
- **Techniques**: Electrochemical measurements including anodization, electrodeposition, photoelectrochemistry, and impedance spectroscopy; x-ray diffraction; Raman spectroscopy and *in-situ* electrochemical Raman; SEM and EDS; AFM; electron beam lithography; electron beam evaporation; 3D modeling with CAD software and 3D printing.

AWARDS

- 2011-2015 Achievement Rewards for College Scientists (ARCS) Foundation Fellowship
- 2014 Doris Kuhlmann-Wilsdorf Outstanding Graduate Student Award
- 2012 NSF East Asia and Pacific Summer Institutes Program Fellowship for Research in Japan
- 2009 James Madison University College of Science and Mathematics: Highest Academic Achievement Award
- 2009 James Madison University Outstanding Senior Physics Major Award

ORGANIZATION MEMBERSHIPS

- **The Electrochemical Society** (2010 – Present): Presented talks on my research at annual meetings. Participated in ECS Data Science Hack Day at Fall 2017 and Fall 2018 meetings. Member at Large – Sensor Division.
- **UVA CESE Lab Safety and Organization Committee** (2014 – 2015): Part of a team which develops and enforces safety policy, consults on experimental and instrument procedures, and organizes laboratory logistics.

PUBLICATIONS

- Tsui, L.; Maines, E.; Evans, L.; Keicher, D.; Lavin, J. "Additive Manufacturing of Alumina Components by Extrusion of *in-situ* UV-cured Pastes." *2018 Solid Freeform Fabrication Symposium Proceedings*. (In Press, 2018).
- Tsui, L.; Benavidez, A.; Evans, L.; Garzon, F. H. "Additively manufactured mixed potential electrochemical sensors for NO_x, C_3H_8, and NH_3 detection." *Prog. Addit. Manuf.* **2018**, https://doi.org/10.1007/s40964-018-0054-2.
- Gokhale, R.; Tsui, L.; Roach, K.; Chen, Y.; Hossen, M. M.; Artyushkova, K.; Garzon, F. H.; Atanassov, P. "Hydrothermal Synthesis of Platinum Group Metal Free Catalysts: Structural Elucidation and Oxygen Reduction Catalysis." *ChemElectroChem*. **2018**, 5, 14, 1848-1853.
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F. H. "Automatic signal decoding and sensor stability of a 3-electrode mixed-potential sensor for NO_x/NH_3 quantification." *Electrochim. Acta*, 2018, **283**, 141-148.
- Tsui, L.; Garzon, F. "CarbonXS GUI – A Graphical Front-end for CarbonXS" *J. Appl. Crystallography.* **2017**, 50, 1830-1833.
- Tsui, L.; Benavidez, A. D.; Evans, L.; Garzon, F. H. "Characterization of Electrochemical Surface Area and Porosity of Zirconia Sensors." *ECS Trans*. **2017**, 77, 1087–1094.
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F.; "Quantitative Decoding of the Response of a Ceramic Mixed Potential Sensor Array for Engine Emissions Control and Diagnostics." *Sens. Act. B Chem.* **2017**, 249, 673-684.
- Workman, M. J.; Serov, A.; Tsui, L.; Atanassov, P.; Artyushkova, K. "Fe–N–C Catalyst Graphitic Layer Structure and Fuel Cell Performance." *ACS Energy Lett.* **2017**, 1489–1493.
- Tsui, L.; Xu, Y.; Dawidowski, D.; Cafiso, D.; Zangari, G. "Efficient Water Oxidation Kinetics and Enhanced Electron Transport in Li-doped TiO_2 Nanotubes Photoanodes." *J. Mater. Chem. A* **2016**, 2, 1–8.
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F.; "A Three Electrode Mixed Potential Sensor for Gas Detection and Discrimination." *ECS Trans*., **2016**, 75, 16, 9-22.
- Tsui, L.; Mibus, M.; Unveroglu, B.; Zangari, G.; "Electrochemical Deposition of Binary Alloys: Effect of Gravity on Composition, Morphology and Dendritic Growth." *Int. J. Microgravity Sci. Appl*., **2016**, 33, 4, 330400.
- Tsui, L.; Zafferoni, C.; Lavacchi, A.; Innocenti, M.; Vizza, F.; Zangari, G.; "Electrocatalytic activity and operational stability of electrodeposited Pd–Co films towards ethanol oxidation in alkaline electrolytes." *J. Power Sources*, **2015**, 293, 815-822.
- Tsui, L.; Nguyen, N. T.; Wang, L.; Kirchgeorg, R.; Zangari, G.; Schmuki, P. "Hierarchical decoration of anodic TiO_2 nanorods for enhanced photocatalytic degradation properties." *Electrochim. Acta*, **2015**, 155, 244-250.
- Tsui, L.; Saito, M.; Homma, T.; Zangari, G. "Trap-state Passivation of Titania Nanotubes by Electrochemical Doping for Enhanced Photoelectrochemical Performance." *J. Mater. Chem. A*, **2015**, 3, 1, 360-367.
- Tsui, L.; Huang, J.; Sabat, M.; Zangari, G. "Visible Light Sensitization of TiO_2 Nanotubes by Bacteriochlorophyll-C Dyes for Photoelectrochemical Solar Cells." *ACS Sustainable Chem. Eng.*, **2014**, 2, 2097-2101.
- Tsui, L.; Zangari, G. "Titania Nanotubes by Electrochemical Anodization for Solar Energy Conversion." *J. Electrochem. Soc.*, **2014**, 161, 7, D3066-D3077.
- Tsui, L.; Zangari, G. "Water content in the anodization electrolyte affects the electrochemical and electronic transport properties of TiO_2 nanotubes: a study by electrochemical impedance spectroscopy." *Electrochim. Acta,* **2014**, *121*, 203-209.
- Tsui, L.; Zangari, G. "Electrochemical Synthesis of Metal Oxides for Energy Applications." In *Modern Aspects of Electrochemistry;* Ed. Djokic, S. Springer, New York, 2014; Vol. 57, pp 217-239.
- Tsui, L.; Zangari, G. "Modification of TiO_2 Nanotubes by Cu_2O for Photoelectrochemical, Photocatalytic, and Photovoltaic Devices." *Electrochim. Acta*, **2014**, *128*, 341-348.
- Schindelholz, E.; Tsui, L.; Kelly, R. G. "Hygroscopic Particle Behavior Studied by Interdigitated Array Microelectrode Impedance Sensors." *J. Phys. Chem. A*, **2014**, *118*, 1, 167-177.
- Tsui, L.; Hildebrand, H.; Lu, J.; Schmuki, P.; Zangari, G. "Metal-insulator transitions in nanocomposite VO_x films formed by anodic electrodeposition." *Appl. Phys. Lett.*, **2013**, *103*, 202102.
- Tsui, L.; Zangari, G. "The Influence of Morphology of Electrodeposited Cu_2O and Fe_2O_3 on the Conversion Efficiency of TiO_2 Nanotube Photoelectrochemical Solar Cells." *Electrochim. Acta*, **2013**, *100*, 200-225.
- Tsui, L.; Homma, T.; Zangari, G. "Photocurrent Conversion in Anodized TiO_2 Nanotube Arrays: Effect of the Water Content in Anodizing Solutions." *J. Phys. Chem. C*, **2013**, *117*, 6979-6989.

- Tsui, L.; Wu, L.; Swami, N.; Zangari, G. "Photoelectrochemical Performance of Electrodeposited Cu_2O on TiO_2 Nanotubes." *ECS Electrochem. Lett.,* **2012**, *1*, D15-19.
- Wu, L.; Tsui, L.; Swami, N.; Zangari, G. "Photoelectrochemical Stability of Electrodeposited Cu_2O Films." *J. Phys. Chem. C,* **2010**, *114*, 11551-11556.

PRESENTATIONS

- Tsui, L.; Plumley, J. B.; Peng, T.; Garzon, F.H. "Silver Iodide Solid-state Ion Conductors for Resistive Switching." Presented at the Rio Grande Symposium on Advanced Materials. (October 2018)
- Tsui, L.; Maines, E.; Evans, L.; Keicher, D.; Lavin, J. "Additive Manufacturing of Alumina Components by Extrusion of UV-curable Pastes." Presented at the Rio Grande Symposium on Advanced Materials. (August 2018).
- Tsui, L.; Plumley, J. B.; Peng, T.; Garzon, F.H. "Additively Manufactured Solid-State Ion Conductors for Resistive Switching Devices." Presented at Americas International Meeting on Electrochemistry and Solid State Science. (October 2018)
- Tsui, L.; Maines, E.; Evans, L.; Keicher, D.; Lavin, J. "Additive Manufacturing of Alumina Components by Extrusion of *in-situ* UV-cured Pastes." Presented at 2018 Solid Freeform Fabrication Symposium. (August 2018).
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F.; "Mixed Potential Sensors for Ammonia/NO_x Automotive Emissions Monitoring" Presented at 29th Rio Grande Symposium on Advanced Materials. (October 2017)
- Tsui, L.; Garzon, F. "CarbonXS GUI – A Graphical Front End for CarbonXS." Presented at 232nd Electrochemical Society Meeting. (October 2017)
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F.; "A Three-Electrode Mixed-Potential Electrochemical Sensor for NO_x/NH_3 Automotive Exhaust Gas Analysis" Presented at 232nd Electrochemical Society Meeting. (October 2017)
- Tsui, L.; Benavidez, A. D.; Evans, L.; Garzon, F. H. "Characterization of Electrochemical Surface Area and Porosity of Zirconia Sensors." Presented at 231st Electrochemical Society Meeting (May 2017)
- Tsui, L.; Benavidez, A.; Palanisamy, P.; Evans, L.; Garzon, F.; "A Three Electrode Mixed Potential Sensor for Gas Detection and Discrimination." Presented at Pacific Rim Meeting on Electrochemical and Solid-State Science (October 2016).
- Tsui, L.; Zangari, G. "Fast Water Oxidation Kinetics in Li-doped TiO_2 Nanotubes." Presented at the 228th Electrochemical Society Meeting (October 2015).
- Tsui, L.; Zangari, G. "Influence of Anodization Conditions on the Electronic Structure of TiO_2 Nanotubes." Presented at 224th Electrochemical Society Meeting (October 2013).
- Tsui, L.; Homma, T.; Zangari, G. "Optimization of the Photoelectrochemical Performance of TiO_2 Nanotubes." Presented at Pacific Rim Meeting on Electrochemical and Solid-State Science (October 2012).
- Tsui, L.; Wu, L.; Swami, N.; Zangari, G. "Cu_2O and Fe_2O_3 modified TiO_2 Nanotubes for Photoelectrochemical Solar Cell Applications." Presented at 220th Electrochemical Society Meeting (October 2011).
- Tsui, L.; Wu, L.; Swami, N.; Zangari, G. "How to Make Hydrogen from the Sun: Photoelectrochemical properties of TiO_2 Nanotubes Modified by Cu_2O and Fe_2O_3." Poster presentation at University of Virginia Engineering Research Symposium (April 2011).
- Tsui, L.; Wu, L.; Swami, N.; Zangari, G. "Cu_2O modified TiO_2 Nanotubes for Solar Cell Applications." Presented at 218th Electrochemical Society Meeting (October 2010).
- Tsui, L.; Paulson, S. "Sample Fabrication for the Study of Carbon Nanotubes." JMU Physics Department Undergraduate Research Symposium (March 2009).
- Tsui, L.; Paulson, S. "Creating an Alignment Procedure for Electron Beam Lithography." JMU Physics Department Undergraduate Research Symposium (March 2008).