

# SUSAN FULLERTON

Associate Professor and Bicentennial Board of Visitors Faculty Fellow

Chemical and Petroleum Engineering, University of Pittsburgh

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## A. EDUCATION

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**The Pennsylvania State University**, University Park, PA USA

Ph.D., Chemical Engineering, August 2009

Dissertation Topic: *Nanoparticle-filled solid polymer electrolytes for rechargeable lithium-ion batteries*

B.S., Chemical Engineering, December 2002 (with distinction)

## B. PROFESSIONAL APPOINTMENTS

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**University of Pittsburgh**, Pittsburgh, Pennsylvania, USA

Department of Chemical and Petroleum Engineering

Associate Professor with Tenure

*Fall 2020 - present*

Vice Chair for Graduate Education

*May 2020 - present*

Bicentennial Board of Visitors Faculty Fellow

*Fall 2019 - present*

Assistant Professor

*Fall 2015 - Fall 2020*

Department of Electrical and Computer Engineering

Courtesy faculty appointment

*Fall 2017 - present*

**University of Notre Dame**, Notre Dame, Indiana, USA

Research Assistant Professor (non-tenure stream, member of graduate committee)

Department of Electrical Engineering

*Fall 2009 - Fall 2015*

Notre Dame Center for Nano Science and Technology (ND*nano*)

## C. PEER-REVIEWED JOURNAL PUBLICATIONS

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H index = 26 (Google Scholar); 20 (publons) as of 3/6/2023

Total number of papers: 54; Fullerton as directing author: 20

Total Citations: 2395 (Google Scholar) 1756 (publons)

Summary of Affiliations: papers 14-54 at Pitt; 6-13 at Notre Dame; 1-5 at Penn State

Notation: \**Directing author*; ‡*Pitt PhD student*; †*Undergraduate*

### University of Pittsburgh

54. Awate, S.S.‡; Mostek, B.†; Kumari, S.; Dong, C.; Robinson, J.A.; Xu, K.; **Fullerton-Shirey, S.K.\*** “Impact of Large Gate Voltages and Ultra-thin Polymer Electrolytes on Carrier Density in Electric-double-layer-gated Two-dimensional Crystal Transistors” *ACS Applied Materials and Interfaces in press*. Impact factor 10.4. **Contribution:** Directed research and guided manuscript preparation.

53. Schilling, A.L.; Cannon E.; **Fullerton-Shirey, S.K.**; Lee, S.E.; Wang, E.W.; Little, S.R. “A ready-to-use, thermoresponsive, and extended-release delivery system for the paranasal sinuses” *Drug Delivery and Translational Research* 12, 708–719 **2022** Impact factor 4.6.  
**Contribution:** DSC analysis and manuscript preparation.

52. Sun, Z.; Xu, K.; Liu, C.; Beaumariage, J.; Liang, J.; Fullerton-Shirey, S.K.; Shi, Z.-Y.; Wu, J.; Snoke, D. “Photoluminescence Switching Effect in a Two-Dimensional Atomic Crystal” *ACS Nano* 15, 12, 19439–19445 **2021**. Impact factor 18.3.

**Contribution:** Electrolyte-gated device measurements and analysis; manuscript preparation.

51. (Invited) Jing, B.; Wang, X.; Shi, Y.; Zhu, Y.; Gao, H.; and **Fullerton-Shirey, S.K.\*** “Combining Hyperbranched and Linear Structures in Solid Polymer Electrolytes to Enhance Mechanical Properties and Room-Temperature Ion Transport” *Frontiers in Chemistry* 9:563864 **2021**. Special Issue - Women in Science: Chemistry; Impact factor 5.2.

**Contribution:** Directed research and guided manuscript preparation.

50. Woeppel, A.<sup>†</sup>; Xu, K.; Kozhakhmetov, A.; Awate, S.<sup>‡</sup>; Robinson, J.A.; **Fullerton-Shirey, S.K.\*** “Single versus Dual Ion Conductors for Electric Double Layer Gating: Finite-Element Modeling and Hall-effect Measurements” *ACS Applied Materials and Interfaces* 12, 36, 40850–40858 **2020**. Impact factor 10.4. **Contribution:** Directed research and guided manuscript preparation.

49. Lin, Y.-C.; Bersch, B.M.; Addou, R.; Xu, K.; Wang, Q.; Smyth, C.M.; Jariwala, B.; Walker II, R.C.; **Fullerton-Shirey, S.K.**; Kim, M.J.; Wallace, R.M.; Robinson, J.A.\* “Modification of the Electronic Transport in Atomically Thin WSe<sub>2</sub> by Oxidation” *Advanced Materials Interfaces* 2000422 **2020**. Impact factor 6.4.

**Contribution:** Electrolyte-gated device measurements and analysis; manuscript preparation.

48. Fathipour, S.; Paletti, P.; **Fullerton-Shirey, S.K.**; Seabaugh, A.C.\* “Electric double layer p-i-n junctions in WSe<sub>2</sub>” *Scientific Reports* 10, 12890 **2020**. Impact factor 5.0.

**Contribution:** Electrolyte-gated data analysis; contributed to manuscript preparation.

47. Subramanian, S.; Xu, K.; Wang, Y.X.; Moser, S.; Simonson, N.; Deng, D.; Crespi, V.; **Fullerton-Shirey, S.K.**; Robinson, J.\* “Tuning transport across MoS<sub>2</sub>/graphene interfaces via as-grown lateral heterostructures” *npj 2D Materials and Applications* 4, 9 **2020**. Impact factor 11.1.

**Contribution:** Electrolyte-gated device measurements and analysis; manuscript preparation.

46. (Invited review) Xu, K. and **Fullerton-Shirey, S.K.\*** “Electric-Double-Layer-Gated Transistors Based on Two-Dimensional Crystals: Recent Approaches and Advances” *Journal of Physics: Materials* 3, 3 **2020**. Impact factor 5.6. **Contribution:** Co-wrote the review.

45. Asghari Heidarlou, M.; Paletti, P.; Jariwala, B.; Robinson, J.A.; **Fullerton-Shirey, S.K.**; Seabaugh, A.C.\* “WSe<sub>2</sub>-on-sapphire field-effect transistors grown by chemical vapor deposition” *IEEE Transactions on Electron Devices* 67, 1839 **2020**. Impact factor 2.9

**Contribution:** Electrolyte-gating; manuscript preparation.

44. Arora, S.; Liang, J.<sup>‡</sup>; **Fullerton-Shirey, S.K.**; Laaser, J.E.\* “Triggerable Ion Release in Polymerized Ionic Liquids Containing Thermally-Labile Diels-Alder Linkages” *ACS Materials Letters* 2, 4, 331-335 **2020**. Impact factor 8.5.

**Contribution:** Directed electrolyte-gated capacitor measurements and analysis; contributed to manuscript preparation.

43. (Invited paper) Liang, J.<sup>‡</sup>; Xu, K.; Arora, S.; Laaser, J.E.; **Fullerton-Shirey, S.K.\*** “Ion-locking in solid polymer electrolytes for reconfigurable gate-less lateral graphene p-n junctions” *Materials (MDPI)* 13(5), 1089 **2020**. Impact factor 3.6.

**Contribution:** Directed research and guided manuscript preparation.

42. Kozhakhmetov, A. Nasr, J.; Zhang, F.; Xu, K.; Briggs, N.; Addou, R.; Wallace, R.; **Fullerton-Shirey, S. K.**; Terrones, M.; Das, S.; Robinson, J. “Scalable BEOL Compatible Two-Dimensional Tungsten Diselenide” *2D Materials*, 7 015029 **2020** Impact factor 7.3

**Contribution:** Directed ion-gated device measurements and analysis; manuscript preparation.

41. Chao, Z.;<sup>‡</sup> Sezginel, K.B.;<sup>‡</sup> Xu, K.; Crouch, G.M.; Gray, A.E.;<sup>†</sup> Wilmer, C.E.; Bohn, P.W.; Go, D.B. **Fullerton-Shirey, S.K.\*** “Silver Nanofilament Formation Dynamics in a Polymer-Ionic Liquid Thin Film by Direct-Write” *Advanced Functional Materials*, 907950 **2019** Impact factor 15.6.

**Contribution:** Directed research and guided manuscript preparation.

40. Liang, J.;<sup>‡</sup> Xu, K.; Wu, M.; Hunt, B.; Wang W.; Cho, K.; **Fullerton-Shirey, S.K.**\* “Molecularly thin all-solid-state non-volatile memory gated by a monolayer electrolyte” *Nano Letters* 19, 29, 8911-8919 **2019** Impact factor 12.

**Contribution:** Directed research and guided manuscript preparation.

39. Hwang, W.S.; Zhao, P.; Kim, S.G.; **Fullerton-Shirey, S.K.**; Yan, R.; Xing, H. Seabaugh, A.; Jena, D.\* “Room-Temperature Graphene-Nanoribbon Tunneling Field-Effect Transistors” *npj 2D Materials and Applications*, 3,43 **2019** Impact factor: 9.3.

**Contribution:** Prepared electrolyte for ion-doping; manuscript preparation.

38. Sun, Z.; Beaumariage, J.; Xu, K.; Liang, J.; Hou, S.; Forrest, S.R.; **Fullerton-Shirey, S.K.**; Snoke, D.W.\* “Electric-field-induced optical hysteresis in single-layer WSe<sub>2</sub>” *Appl. Phys. Lett.* 115, 161103 **2019**. Impact factor 3.5. **Contribution:** Electrical measurements; manuscript preparation.

37. Xu, K.; Liang, J.;<sup>‡</sup> Bostian, M.;<sup>‡</sup> Woepfel, A.;<sup>†</sup> Ding, H.; Chao, Z.;<sup>‡</sup> McKone, J.R.; Beckman, E.J.; **Fullerton-Shirey, S.K.**\* “Electric double layer gated two-dimensional field-effect transistor using a single-ion conductor” *ACS Applied Materials and Interfaces* 11 (39) 35879 **2019**. Impact factor 8.8.

**Contribution:** Directed research, guided manuscript preparation; Xu & Liang co-first authors.

36. Paletti, P.; Yue, R.; Hinkle, C.; **Fullerton-Shirey, S.K.**, Seabaugh, A.\* “Two-dimensional electric-double-layer Esaki diode” *npj 2D Materials and Applications* 3, 19 **2019**. Impact factor: 9.3

**Contribution:** Guidance on electrolyte gating; manuscript preparation.

35. Vasudevan, S.; **Fullerton-Shirey, S.K.**\* “Effect of Nanoparticle Shape on the Electrical and Thermal Properties of Solid Polymer Electrolytes” *J. Phys. Chem. C*, 123, 10720 **2019**. IF 4.5.

**Contribution:** Directed research and guided manuscript preparation.

34. Han, D.; Crouch, G.M.; Chao, Z.;<sup>‡</sup> **Fullerton-Shirey, S.K.**, Go, D.; Bohn, P.W.\* “Nanopore-templated silver nanoparticle arrays photopolymerized in zero-mode waveguides” *Frontiers in Chemistry*, 7, 2016, **2019**, Invited. Impact factor 4.0.

**Contribution:** Guidance on photopolymerized electrolyte; contributed to manuscript preparation.

33. Liang, J.;<sup>‡</sup> Xu, K.; Toncini, B.<sup>†</sup>; Bersch, B.; Robinson, J.; **Fullerton-Shirey, S.K.**\* “Impact of post-lithography polymer residue on the electrical characteristics of MoS<sub>2</sub> and WSe<sub>2</sub> field effect transistors” *Advanced Materials Interfaces*, 1801321 **2018**. Impact factor 5.0.

**Contribution:** Directed research and guided manuscript preparation.

32. Xu, K.; Islam, M.M.; Guzman, D.M.; Seabaugh, A.; Strachan, A.; **Fullerton-Shirey, S.K.**\* “Pulse Dynamics of Electric Double Layer Formation on All-Solid-State Graphene Field-Effect Transistors” *ACS Applied Materials and Interfaces* 10, 43166 **2018**. Impact factor 8.8.

**Contribution:** Directed research and guided manuscript preparation.

31. Zhang, K.; Bersch, B.M.; Zhang, F.; Briggs, N.C.; Subramanian, S.; Xu, K.; Chubarov, M.; Wang, K.; Lerach, J.O.; Redwing, J.M.; **Fullerton-Shirey, S.K.**; Terrones, M.; Robinson, J.A.\* “Considerations for Utilizing Sodium Chloride in Epitaxial Molybdenum Disulfide” *ACS Applied Materials and Interfaces* 10, 40831 **2018**. Impact factor 8.8.

**Contribution:** Electrolyte-gated device measurements and analysis; manuscript preparation.

30. Chao, Z.;<sup>‡</sup> Radka, B.P.<sup>†</sup>; Xu, K.; Crouch, G. M.; Han, D. Go, D. B., Bohn, P. W., **Fullerton-Shirey, S.K.**\* “Direct-write formation and dissolution of silver nanofilaments in ionic liquid-polymer electrolyte composites” *Small*, 1802023 **2018**. Impact factor 9.6.

**Contribution:** Directed research and guided manuscript preparation.

29. Zhang, K.; Bersch, B.; Joshi, J.; Addou, R.; Cormier, C.R.; Zhang, C.; Xu, K.; Briggs, N.C.;

Wang, D.; Subramanian, S.; Cho, K.; **Fullerton-Shirey, S.**; Wallace, R.M.; Vora, P.M.; Robinson, J.\* “Tuning the Electronic and Photonic Properties of Monolayer MoS<sub>2</sub> via In Situ Rhenium Substitutional Doping,” *Advanced Functional Materials*, 28, 7 **2018**. Impact factor 12.1

**Contribution:** Directed electrical device measurements and analysis; manuscript preparation.

28. Lin, Y.-C.; Jariwala, B.; Bersch, B.; Xu, K.; Nie, Y.; Wang, B.; Eichfeld, S.; Zhang, X.; Choudhury, T.; Pan, Y.; Addou, R.; Smyth, C.M.; Li, J.; Zhang, K.; Haque, M.; Fölsch, S.; Feenstra, R.; Wallace, R.M.; Cho, K.; **Fullerton-Shirey, S.**; Redwing, J.; Robinson, J.\* “Realizing Large-Scale, Electronic-Grade Two-Dimensional Semiconductors,” *ACS Nano*, 12, 965-975 **2018**. Impact factor 12.

**Contribution:** Directed electrical device measurements and analysis; manuscript preparation.

27. Zhang, K.; Borys, N.J.; Bersch, B.M.; Bhimanapati, G.R.; Xu, K.; Wang, B.; Wang, K.; Labella, M.; Williams, T.A.; Haque, Md Al; Barnard, E.S.; **Fullerton-Shirey, S.K.**; Schuck P.; Robinson, J.\* “Deconvoluting the Photonic and Electronic Response of 2D Materials: The Case of MoS<sub>2</sub>” *Scientific Reports* 7, 16938 **2017**. Impact factor 4.3

**Contribution:** Directed electrical device measurements and analysis; manuscript preparation.

26. Subramaniana, S.; Deng, D.D.; Xu, K.; Simonson, N.; Wang, K.; Zhang, K.; Li, J.; Feenstra, R.; **Fullerton-Shirey, S.K.**; Robinson, J.A.\* “Properties of synthetic epitaxial graphene/molybdenum disulfide lateral heterostructures” *Carbon*, **2017** 125, 551. Impact factor 6.2

**Contribution:** Directed electrical device measurements and analysis; manuscript preparation.

25. Li, H.; Xu, K.; Buchanan, B.†; Lu, H.; Lin, Y.-C.; Robinson, J.; Seabaugh, A.; **Fullerton-Shirey, S.K.**\* “Electric Double Layer Dynamics in Polyethylene Oxide LiClO<sub>4</sub> on Graphene Transistors” *J. Phys. Chem. C.*, **2017** 121, 16996. Impact factor 4.8

**Contribution:** Directed research and guided manuscript preparation.

24. Kinder, E.; Fuller, A.†; Lin, Y.-C.; Robinson, J.; **Fullerton-Shirey, S.K.**\* “Increasing the room-temperature electric double layer retention time in two-dimensional crystal FETs” *ACS Applied Materials and Interfaces* **2017** 9, 25006. Impact factor 8.8

**Contribution:** Directed research and guided manuscript preparation.

23. Young, J.R.; Chilcote, M.; Barone, M.; Xu, J.; Katoch, Luo, J.K.; Mueller, S.; Asel, T.J.; **Fullerton-Shirey, S.K.**; Kawakami, R.; Gupta, J.A.; Brillson, L.J.; Johnston-Halperin, E.\* “Uniform large-area growth of nanotemplated high-quality monolayer MoS<sub>2</sub>” *Appl. Phys. Lett.*, **2017** 110, 263103. Impact factor 3.4

**Contribution:** Electrolyte for electrolyte gating of devices; manuscript preparation.

22. Xu, K.; Lu, H.; Kinder, E.; Seabaugh, A.; **Fullerton-Shirey, S.K.**\* “Monolayer Solid State Electrolyte for Electric Double Layer Gating of Graphene Field-Effect Transistor” *ACS Nano* **2017** 11 (6), 5453. Impact factor 12

**Contribution:** Directed research and guided manuscript preparation.

21. Crouch, G.; Han, D.; **Fullerton-Shirey, S.K.**; Go, D.\*; Bohn, P.\* “Addressable Direct-Write Nanoscale Filament Formation and Dissolution by Nanoparticle-Mediated Bipolar Electrochemistry” *ACS Nano* **2017** 11 (5), 4976. Impact factor 12

**Contribution:** Co-developed experimental approach and directed polymer electrolyte effort; manuscript preparation.

20. Park, J.H.; Ravavar, L.; Kwak, I.; **Fullerton-Shirey, S.K.**; Choudhury, P.; Kummel, A.C.\* “Growth Mode Transition from Monolayer by Monolayer to Bilayer by Bilayer in Molecularly Flat Titanyl Phthalocyanine Film” *J. Phys. Chem. C.* **2017** 121, 6721. Impact factor 4.8

**Contribution:** Contributed to TiOPc as seed layer; manuscript preparation.

19. Kahn, A.A.; Vigil, G.D.; Zhang, Y.; **Fullerton-Shirey, S.K.**; Howard, S.S.\* “Silica-coated ruthenium-complex nanoprobe for two-photon oxygen microscopy in biological media” *Optical Materials Express* **2017** 7, 3. Impact factor 2.6

**Contribution:** Co-developed nanoprobe; manuscript preparation.

18. Wang, W.-H.; Gong, C.; Wang, W.; Kong, F.; Kim, H.; **Fullerton-Shirey, S.K.**; Seabaugh, A.; Cho, K.\* “Energetics of metal ion adsorption on and diffusion through crown ethers: first principles study on two-dimensional electrolyte” *Solid State Ionics* **2017** 301, 176-181. Impact factor 2.1

**Contribution:** Co-contributed original idea for 2D electrolyte; manuscript preparation.

17. Fathipour, S.; Pandey, P.; **Fullerton-Shirey, S.**; Seabaugh, A.\* “Electric-double-layer doping of WSe<sub>2</sub> field-effect transistors using polyethylene-oxide cesium perchlorate” *J. Appl. Phys.*, **2016** 120, 234902. Impact factor: 2.2

**Contribution:** Guided polymer electrolyte work and data analysis; manuscript preparation.

16. Lin, Z.; McCreary, A.; Briggs, N.; Subramanian, S.; Zhang, K.; Sun, Y.; Li, X.; Borys, N.; Yuan, H.; **Fullerton-Shirey, S.**; Chernikov, A.; Zhao, H.; McDonnell, S.; Lindenberg, A.; Xiao, K.; LeRoy, B.; Drndic, M.; Hwang, J.; Park, J.; Chhowalla, M.; Schaak, R.; Javey, A.; Hersam, M.; Robinson, J.; Terrones, M. “2D Materials Advances: From Large Scale Synthesis and Controlled Heterostructures to Improved Characterization Techniques, Defects and Applications” *2D Materials*, **2016** 3, 042001. Impact factor: 7.3 **Contribution:** Electrolyte doping of 2D materials (invited review).

15. Park, J.H.; Fathipour, S.; Kwak, I.; Sardashti, K.; Ahles, C.F. Wolf, S.F.; Edmonds, M.; Vishwanath, S.; Xing, H.G.; **Fullerton-Shirey, S.K.**; Seabaugh, A.; Kummel, A.C.\* “Atomic Layer Deposition of Al<sub>2</sub>O<sub>3</sub> on WSe<sub>2</sub> Functionalized by Titanyl Phthalocyanine” *ACS Nano*, **2016** 10, 6888-6896. Impact factor: 12

**Contribution:** Contributed to the development of TiOPc as seed layer; manuscript preparation.

14. Park, J.H.; Vishwanath, S.; Liu, X.; Zhou, H.; Eichfeld, S.M.; **Fullerton-Shirey, S.K.**; Robinson, J.A.; Feenstra, R.M.; Furdyna, J.; Jena, D.; Xing, H.G.\*; Kummel, A.C.\* “Scanning Tunneling Microscopy and Spectroscopy of Air Exposure Effects on Molecular Beam Epitaxy Grown WSe<sub>2</sub> Monolayers and Bilayers” *ACS Nano*, **2016** 10, 4258-4267. Impact factor: 12

**Contribution:** Chemical models of air oxidation; manuscript preparation.

## University of Notre Dame

13. Park, J.H.; Movva, C.P.M.; Chagarov, E.; Sardashti, K.; Chou, H.; Kwak, I.; Hu, K.-T.; **Fullerton-Shirey, S.K.**; Choudhury, P.; Banerjee, S.K.; Kummel, A.C.\* “In-Situ Observation of Initial Stage in Dielectric Growth, and Deposition of Ultrahigh Nucleation Density Dielectric on Two-Dimensional Surfaces” *Nano Lett.*, **2015**, 15, 6626-6633. Impact factor: 13.6

**Contribution:** Solution-casting of monolayers; contributed to manuscript preparation.

12. Lu, H.; Kwak, I.; Park, J.H.; O’Neill, K.; Furuyama, T.; Kobayashi, N.; Seabaugh, A.; Kummel, A.; **Fullerton-Shirey, S.K.**\* “Solution-Cast Monolayers of Cobalt Crown Ether Phthalocyanine on Highly Ordered Pyrolytic Graphite” *J. Physical Chemistry C*, **2015**, 119, 21992-22000. Impact factor: 4.8 **Contribution:** Directed research and guided manuscript preparation.

11. Wang, W.-H.; Gong, C.; Wang, W.; **Fullerton-Shirey, S.K.**; Seabaugh, A.; Cho, K.\* “First-Principles Study of Crown Ether and Crown Ether-Li Complex Interactions with Graphene” *J. Physical Chemistry C*, **2015**, 119, 20016-20022. Impact factor: 4.8

**Contribution:** Motivated study by proposing crown ether as potential candidate for ion memory; discussed results and directions; contributed to manuscript preparation.

10. Xu, H.; Kinder, E. W.; Fathipour, S.; Seabaugh, A. C.; **Fullerton-Shirey, S.K.\*** “Reconfigurable ion gating of 2H-MoTe<sub>2</sub> field-effect transistors using poly(ethylene oxide)-CsClO<sub>4</sub> solid polymer electrolyte” *ACS Nano*, **2015**, 9, 4900-4910. Impact factor: 12

**Contribution:** Directed research and guided manuscript preparation.

9. Khan, A.A.; **Fullerton-Shirey, S.K.**; Howard, S.S.\* “Easily prepared ruthenium-complex nanomicroprobe probes for two-photon quantitative imaging of oxygen in aqueous media” *RSC Advances*, **2015**, 5, 291-300. Impact factor: 3.7

**Contribution:** Developed experimental procedure for probe encapsulation, provided input on data analysis, contributed to manuscript preparation.

8. Schaeztl, D.M.<sup>†</sup>; Li, P.; Chaudhari, N.; Bernstein, G.H.; **Fullerton-Shirey, S.K.\*** “Magnetic alignment of gamma (core) - alpha (shell) Fe<sub>2</sub>O<sub>3</sub> nanorods in a solid polymer electrolyte for Li-ion batteries” *J. Physical Chemistry C*, **2014**, 118, 18836-18845. 2012 Impact factor: 4.8

**Contribution:** Conceived of and directed project, designed experiments, aided first author (undergraduate student) with data analysis and manuscript preparation.

7. Elliott, L.C.C.; Jing, B.; Akgun, B.; Zhu, Y.; Bohn, P.W.; **Fullerton-Shirey, S.K.\*** “Loading and distribution of a model small molecule drug in poly(N-isopropyl-acrylamide) brushes - a neutron reflectometry and AFM study” *Langmuir* **2013**, 29, 3259-3268. 2012 Impact Factor: 4.19

**Contribution:** Conceived of and directed project, designed experiments, collected and analyzed neutron scattering data, co-wrote manuscript with Elliott.

6. Do, N.S.<sup>†</sup>; Schaeztl, D.M.<sup>†</sup>; Dey, B.; Seabaugh, A.C.; **Fullerton-Shirey, S.K.\*** “Influence of Fe<sub>2</sub>O<sub>3</sub> nanofiller shape on the conductivity and thermal properties of solid polymer electrolytes:  $\hat{E}$  nanorods versus nanospheres” *J. Phys. Chem. C* **2012**, 116, 21216-21223. 2012 Impact factor: 4.8

**Contribution:** Conceived of and directed project, designed experiments, aided first author (Notre Dame undergraduate) with data analysis and manuscript preparation.

## Penn State

5. **Fullerton-Shirey, S.K.\***; Ganapatibhotla, V.N.R.; Shi, W.; Maranas, J.K. “Influence of humidity and crystallization time on the ionic conductivity of nanoparticle-filled solid polymer electrolytes” *Journal of Polymer Science, Part B: Polymer Physics* **2011**, 49, 1496-1505. 2012 Impact factor: 2.21

4. **Fullerton-Shirey, S.K.**; Maranas, J.K.\* “Structure and mobility of PEO/LiClO<sub>4</sub> solid polymer electrolytes filled with Al<sub>2</sub>O<sub>3</sub> nanoparticles” *Journal of Physical Chemistry C* **2010**, 114, 9196-9206. 2012 Impact factor: 4.8

3. **Fullerton-Shirey, S.K.**; Maranas, J.K.\* “Effect of LiClO<sub>4</sub> on the structure and mobility of PEO-based solid polymer electrolytes” *Macromolecules* **2009**, 42(6), 2142-2156. 2012 Impact factor: 5.5

2. **Fullerton, S.K.**; Maranas, J.K.\* “A molecular dynamics study of the structural dependence of boron oxide nanoparticles on shape” *Nano Letters* **2005**, 5, 363-368. 2005 Impact factor: 9.9

1. **Fullerton, S.K.<sup>†</sup>**; Maranas, J.K.\* “A molecular interpretation of vitreous boron oxide dynamics” *Journal of Chemical Physics* **2004**, 121, 8562-8570. 2005 Impact factor: 3.14

## NON-PEER REVIEWED PUBLICATIONS

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### (i) INVITED PUBLICATIONS

2. Seabaugh, A.; Fathipour, S.; Li, W.; Lu, H.; Park, J.-H.; Kummel, A.C.; Jena, D.; **Fullerton-Shirey, S.K.**; Fay, P. “Steep subthreshold swing tunnel FETs: GaN/InN/GaN and transition metal dichalcogenide channels” 2015, International Electron Devices Meeting (IEDM), *Invited*.
1. **Fullerton-Shirey, S.K.**; Maranas, J.K. “Molecular mobility and ion transport in solid polymer electrolytes for lithium batteries”, *NIST Center for Neutron Research 2009 Annual Report* Special Publication 1105, 32-33.

### (ii) PATENT

**Fullerton-Shirey, S.K.**; Seabaugh, A.C. “Single transistor random access memory using ion storage in two-dimensional crystals” *Patent* 9,899,480 *Issue Date*: February 20<sup>th</sup>, 2018.

Beckman, E.J. **Fullerton-Shirey, S.K.**; Bunke, S.; Bingaman, J; Ashmar, A.E. “Gradient cross-linked polymer with triggerable decomposition into benign byproducts and methods of using the same” *Patent* PCT/US2022/038001 *Filing Date*: July 22, 2022

### (iii) ARTICLES HIGHLIGHTING FULLERTON’S RESEARCH PROGRAM

6. “Engineering alumna named an Alfred P. Sloan Research Fellow” Jamie Oberdick, *Penn State News*, **May 26<sup>th</sup>, 2020**. <https://news.psu.edu/story/621180/2020/05/26/academics/engineering-alumna-named-alfred-p-sloan-research-fellow>
5. “Alumni Spotlight” *Penn State Engineering Magazine* **Spring/Summer 2019**, pg 38. <http://online.flipbuilder.com/wool/xvww/mobile/index.html>
4. “Mason awardees display benefits of outsider perspectives” Elana Kimbrell, *Science* **2019** 363, 357
3. “Marion Milligan Mason Awards: V.E. Ferry, S.K. Fullerton, L.C. Hsiao, H.J. Kulik, C.S. Schindler” *Angewandte Chemie* **25 January 2019** <https://doi.org/10.1002/anie.201900118>
2. “Researchers Look For Ways To Make Juice Boxes, Chip Bags And Other Layered Packaging Recyclable” Joaquin Gonzalez, *National Public Radio (NPR) Pittsburgh* **6 March 2018**.
1. “Davos: the inventions cutting plastic consumption” *The British Broadcasting Corporation (BBC)* **23 January 2018**.

### (iv) INVITED PRESENTATIONS

**Summary:** Presentations: 13-41 with Pitt affiliation; Non-technical 1-7 with Pitt affiliation.

41. **CMD29** “Strain-induced semiconducting to semi-metallic phase transition in MoTe<sub>2</sub> using a single-ion conductor” **Fullerton Shirey, S.K.** August 25<sup>th</sup>, 2022 Manchester, England (Virtual).
40. *Materials Research Society (MRS) Spring Meeting* “Ultrathin solid polymer electrolytes for electric double layer gating of 2D crystal FETs” **Fullerton Shirey, S.K.** May 9<sup>th</sup>, 2022 Honolulu, Hawaii, USA.
39. *University of Pennsylvania - Department of Chemistry* “Beyond Batteries: Reimagining the role of ions in electronics” **Fullerton Shirey, S.K.** March 31<sup>st</sup>, 2022, Philadelphia, PA, USA.

38. *Penn State MRSEC Seminar Series* “Strain-induced semiconducting to semi-metallic phase transition in MoTe<sub>2</sub> using a single-ion conductor” **Fullerton Shirey, S.K.** March 28<sup>th</sup>, 2022, University Park, PA, USA.
37. *University of California Santa Barbara - Department of Materials Science and Engineering* “Beyond Batteries: Reimagining the role of ions in electronics” **Fullerton Shirey, S.K.** May 21<sup>st</sup>, 2021, Virtual.
36. *University of California at Berkeley - Department of Materials Science and Engineering* “Beyond Batteries: Reimagining the role of ions in electronics” **Fullerton Shirey, S.K.** February 25<sup>th</sup>, 2021, Virtual.
35. *Materials Research Society (MRS) Fall Meeting* “Molecularly Thin Electrolyte for All Solid-State Nonvolatile Two- Dimensional Crystal Memory” **Fullerton Shirey, S.K.** December 2<sup>nd</sup>, 2019 Boston MA USA.
34. *University of Notre Dame - Department of Electrical Engineering* “Beyond Batteries: Reimagining the role of ions in electronics” **Fullerton Shirey, S.K.** October 11<sup>th</sup> 2019, Notre Dame, IN USA.
33. *Keynote: Penn State Chemical Engineering Research Day* “The Power of the Outsider” **Fullerton Shirey, S.K.** September 20<sup>th</sup> 2019, University Park, PA USA.
32. *AAAS Marion Milligan Mason Award for Women in the Chemical Sciences Symposium and Reception, American Chemical Society (ACS) Fall meeting* “Beyond batteries: Reinventing the role of ions in electronics and smart materials” **Fullerton Shirey, S.K.** August 28<sup>th</sup> 2019, San Diego, CA USA.
31. *American Association for the Advancement of Science (AAAS) Awards Ceremony: Marion Milligan Mason Award for Women in the Chemical Sciences* “The Power of the Outsider” **Fullerton Shirey, S.K.** December 13<sup>th</sup> 2018, Washington, D.C. USA.
30. *Michigan State University - Department of Chemical Engineering* “Using ions to control transport in 2D materials” **Fullerton Shirey, S.K.** December 6<sup>th</sup> 2018, East Lansing, MI USA.
29. *US - EU Workshop on 2D Layered Materials and Devices*, San Sebastian, Spain; **Fullerton-Shirey, S.K.** September 13, 2018. Oral. Workshop by invitation only.
28. *Compound Semiconductor Week (CSW 2018)* “Electric Double Layer Dynamics in Graphene FETs: Using Ions to Control Transport in Two-Dimensional Materials” **Fullerton Shirey, S.K.**, Xu, K.; Islam, M.M.; Guzman, D.; Seabaugh, A.; Strachan, A. *Session: Novel Materials (2D Materials)* May 30<sup>th</sup> 2018, Boston, MA USA.
27. *University of Texas at Dallas - Department of Materials Science and Engineering* “Using ions to control transport in 2D materials” **Fullerton Shirey, S.K.** April 6<sup>th</sup> 2018, Dallas, TX USA.
26. *Case Western Reserve University - Condensed Matter Physics Seminar Series* “Using ions to control transport in 2D materials” **Fullerton Shirey, S.K.** April 2<sup>nd</sup> 2018, Cleveland, OH USA.
25. *Cornell University - Department of Materials Science and Engineering* “Using ions to control transport in 2D materials” **Fullerton Shirey, S.K.** March 15<sup>th</sup> 2018, Ithaca, NY USA.
24. *University of Michigan - Department of Chemical Engineering* “Using ions to control transport in 2D materials - a path to low-power electronics at the limit of scaling” **Fullerton Shirey, S.K.** September 19<sup>th</sup> 2017, Ann Arbor, MI, USA.



23. ***Electrochemical Society (ECS) spring meeting*** “Electrostatic Double Layer Flash Memory Based on Two-dimensional Crystals” **Fullerton Shirey, S.K.**, Xu, K.; Liang, J.; Lu, H.; Wang, W.; Kim, H.; Kwak, I.; Cho, K.; Kummel, A.C.; Seabaugh, A. *Session: Properties and applications of 2D layered materials*, May 29<sup>th</sup> 2017, New Orleans, LA, USA.
22. ***TMS 2017 (The Minerals, Metals and Materials Society annual conference)*** “Using Ions to Control Transport in Two-dimensional Materials for Electronics” Xu, K.; Liang, J.; Lu, H.; Kinder, E.; Kummel, A.; Seabaugh, A.; **Fullerton-Shirey, S.K.** February 27<sup>th</sup>, 2017, San Diego, CA, USA. *Note*: presentation delivered by postdoc Dr. Ke. Xu because I was 9 months pregnant
21. ***The Pennsylvania State University - Department of Materials Science and Engineering; Polymer Physics Seminar Series*** “Polymer electrolytes for exploring transport in two-dimensional materials for electronics” **Fullerton Shirey, S.K.** January 30<sup>th</sup>, 2017, University Park, PA, USA.
20. ***University of California at Berkeley - Department of Electrical Engineering and Computer Science*** “Using ions to control transport in two-dimensional materials for electronics” **Fullerton Shirey, S.K.** November 16<sup>th</sup>, 2016, Berkeley, CA, USA.
19. ***Science 2016: Game Changers - University of Pittsburgh*** “Using ions to control transport in two-dimensional materials for electronics” **Fullerton Shirey, S.K.** October 20<sup>th</sup>, 2016, Pittsburgh, PA, USA.
18. ***Tec Talk, Micron Technology, Inc.*** “Polymer/semiconductor electric double layers for memory and selectors” **Fullerton Shirey, S.K.** and Alan Seabaugh, September 30<sup>th</sup>, 2016, Boise, ID.
17. ***CMOS Emerging Technologies Research*** “Using ions to control transport in 2D materials for low-power transistors and memory” **Fullerton Shirey, S.K.**, May 27<sup>th</sup>, 2016, Montreal Canada.
16. ***The Pennsylvania State University, 4th Annual Workshop on 2D materials - Graphene and Beyond: From Atoms to Applications*** “Nanoionic two-dimensional memory” **Fullerton Shirey, S.K.** May 10<sup>th</sup>, 2016, University Park, PA, USA.
15. ***Innovation in Materials, 2016, sponsored by PPG Industries*** “Using ions to control transport in two-dimensional materials for electronics” **Fullerton Shirey, S.K.**, May 5, 2016, Pittsburgh, PA, USA.
14. ***Materials Research Society (MRS) Spring Meeting*** “2D Electrolytes for the Development of 2D Crystal Memory” **Fullerton Shirey, S.K.**, Xu, K.; Lu, H.; Wang, W.; Kim, H.; Kwak, I.; Cho, K.; Kummel, A.C.; Seabaugh, A. *Session: Novel Materials for End-of-Roadmap Devices in Logic, Power and Memory*, March 30<sup>th</sup> 2016, Phoenix, AZ, USA.
13. ***University of Pittsburgh - Department of Electrical and Computer Engineering*** “Field-controlled ion gating of two-dimensional crystals for logic and memory” **Fullerton Shirey, S.K.** November 4, 2015.
12. ***Carnegie Mellon University - 2D Materials Center*** “Ion gating of 2D materials for logic and memory” **Fullerton Shirey, S.K.** September 16, 2015.
11. ***University of California Riverside - Department of Electrical and Computer Engineering*** “Engineering ion-electron transport for low-power, two-dimensional electronics” **Fullerton Shirey, S.K.** May 11, 2015.
10. ***US - EU Workshop on 2D Layered Materials and Devices***, Arlington, VA, USA “Nanometer-thick Ion Conductors for 2D Crystal Memory” **Fullerton-Shirey, S.K.**, Lu. H.; Wang, W.; Kim, H.; Kwak, I.; Furuyama, T.; Kobayashi, N.; Cho, K.; Kummel, A., Seabaugh, A.” April 22-24, 2015. Poster. Workshop by invitation only.

9. *West Virginia University - Department of Chemical Engineering* “Engineering ion-electron transport for low-power, two-dimensional electronics” **Fullerton Shirey, S.K.** March 11, 2015.
8. *University of Pittsburgh - Department of Chemical and Petroleum Engineering* “Engineering ion-electron transport for low-power, two-dimensional electronics” **Fullerton Shirey, S.K.** February 23, 2015.
7. *University of Minnesota - Materials Research Science and Engineering Center (MRSEC)* “Field-controlled ion gating for low power transistors and graphene memory” **Fullerton Shirey, S.K.** September 26, 2014.
6. *STARnet Accel eWorkshop* “Field-controlled ion doping of transition metal dichalcogenide FETs and two-dimensional ion-graphene memory” **Fullerton Shirey, S.K.** Available by WebEx to all STARnet researchers. May 7, 2014.
5. *Institute for Nanoelectronics, Technische Universitat Munchen (TUM)* “Influence of metal oxide nanofillers on the ionic conductivity of solid polymer electrolytes for rechargeable lithium-ion batteries” Do, S.; Schaetzel, D.; Dey, B.; Seabaugh, A.C.; **Fullerton Shirey, S.K.** December 2011. Munich, Germany.
4. *American Chemical Society (ACS) Central Regional Meeting* “Conductivity improvement in nanorod-filled solid polymer electrolytes for lithium-ion batteries” Dey, B.; Do, S.; Schaetzel, D.; Seabaugh, A.C.; **Fullerton Shirey, S.K.** *New Advances in Polymer Materials* June 2011. Indianapolis, IN, USA.
3. *American Conference on Neutron Scattering (ACNS)* “Polymer mobility of nanoparticle-filled Solid Polymer Electrolytes using Neutron Scattering” **Fullerton Shirey, S.K.**; Maranas, J.K. *Neutron Scattering for the Study of Soft Matter Tutorial*, June 2010. Ottawa, ON, Canada.
2. *2010 National Academies Panel on Neutron Research* “Structure and mobility of PEO-based Solid Polymer Electrolytes” **Fullerton Shirey, S.K.**; Maranas, J.K. *NIST Center for Neutron Research*, March 2010. Gaithersburg, MD, USA.
1. *NSF Review: Center for High Resolution Neutron Scattering* “Structure and mobility of PEO-based Solid Polymer Electrolytes” **Fullerton Shirey, S.K.**; Maranas, J.K. *NIST Center for Neutron Research*, October 2009. Gaithersburg, MD, USA.

#### Non-technical Invited Talks

8. *U. of Pittsburgh, Women in Engineering Program - one hour evening workshop on imposter syndrome* “Using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, October 3, 2022, Pittsburgh, PA.
7. *Gordon Research Conference on 2D Electronics Beyond Graphene* “GRC Power Hour: Non-promotable work” **Fullerton Shirey, S.K.**, June 13<sup>th</sup>, 2022, Southern New Hampshire University, New Hampshire, USA.
6. *U. of Pittsburgh, Society of Women Engineers FIERCE Conference* “Using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, February 5<sup>th</sup>, 2022, virtual.
5. *U. of Pittsburgh, Engineering Graduate Student Organization* “Navigating the work/life balance and using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, September 9<sup>th</sup>, 2020, Pittsburgh, PA.
4. *U. of Pittsburgh, Department of Neurology “Grant Rounds” Seminar Series* “Navigating the work/life balance and using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, February 5<sup>th</sup>, 2020, Pittsburgh, PA.

3. *Penn State Women in Materials Science Lecture Series* “Curiosity about materials is the driving force behind my career - starting with bubble gum” **Fullerton Shirey, S.K.**, April 8<sup>th</sup>, 2019, University Park, PA.

2. *Theta Tau 2019 Midwest Conference* “Using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, March 30<sup>th</sup>, 2019, University of Pittsburgh.

1. *The Pittsburgh Quantum Institute (PQI): Women in Quantum Science and Engineering Lecture Series* “Navigating the work/life balance and using the imposter syndrome to help you excel in your career” **Fullerton Shirey, S.K.**, February 7<sup>th</sup>, 2017, University of Pittsburgh.

**Note:** Conference presentations with Fullerton as presenting author, directing author, and co-author are found below in section L.

## D. RESEARCH FUNDING

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### PEER-REVIEWED EXTERNAL RESEARCH FUNDING

#### Ongoing Research Support

1. **Title:** *Ion-Locked Polymorphic Electronics for Hardware Security*  
**Investigators** Susan Fullerton (PI), Eric Beckman, Ke Xu  
**Source:** NSF ECCS EPMD  
**Amount:** \$553,482 over 3 years  
**Duration** 2021 - 2024  
**Summary:** Electrolytes to create polymorphic electronics for hardware security.
2. **Title:** *Center for Nano Science (Penn State MRSEC)*  
**Investigators** Vin Crespi (PI) + co-PIs including Fullerton  
**Source:** NSF DMR MRSEC  
**Amount:** \$20M over 6 years (Fullerton lab: \$557,000)  
**Duration** 2020 - 2026  
**Summary:** IRG1 - 2D Polar Metal Heterostructures. Use electric double layer (EDL) gating of two-dimensional (2D) metals to uncover new optical and electrical properties;
3. **Title:** *CAREER: Scaling Electrolytes to a Single Monolayer for Low-Power Ion-Gated Electronics with Unconventional Characteristics*  
**Investigator:** Susan Fullerton (PI)  
**Amount:** \$540,000 over 5 years  
**Source:** NSF-DMR-EPM  
**Duration:** June 2019 - May 2024  
**Summary:** Development of a single monolayer ion conductor for application in flash memory.
4. **Title:** *Reinventing the role of ions in electronics*  
**Investigators** Susan Fullerton  
**Source** 2020 Alfred P. Sloan Research Fellowships in Chemistry  
**Amount:** \$75,000 over 2 years  
**Duration** Fall 2020 - Fall 2022

#### Completed Research Support

5. **Title:** *DURIP: Acquisition of a Broadband Dielectric Spectrometer for Characterizing Dynamics in Ionic Soft Materials*  
**Investigators** Jennifer Laaser, Susan Fullerton, Geoff Hutchinson, Sean Garrett-Roe, Tara Meyer  
**Source** Air Force (AFOSR)  
**Amount:** \$313,000

**Duration** Spring 2021

**Summary:** Funds to purchase a Broadband Dielectric Spectrometer (BDS).

6. **Title:** *A New Approach to Explore the Semiconductor-to-Metal Phase Transition in Two-Dimensional Crystals Using Ionomers*

**Investigators:** Susan Fullerton (PI), Eric Beckman (co-PI)

**Amount:** \$496,272

**Source:** NSF-DMR-EPM

**Duration:** July 2016 - June 2021

**Summary:** Demonstrate steep, sub-threshold switching by using a single-ion conductor to induce the semiconductor to metal transition in single-layer MoTe<sub>2</sub>.

7. **Title:** *Recyclable, flexible and durable packaging created through nano-engineering*

**Investigators:** Eric Beckman (PI), Susan Fullerton (co-PI), Sachin Velankar (co-PI)

**Amount:** \$200,000 over 1 year

**Source:** The Ellen MacArthur Foundation and Nine Sigma

**Duration:** March 2018 - March 2019

**Summary:** International award - one of 5 winners. Use nano-engineering to create a recyclable material that can replace complex multi-layered packaging.

**Fullerton's role:** Develop oxygen barriers and establish structure-property relationships

8. **Title:** *Beyond batteries: Reinventing the role of ions in electronics and smart materials*

**Investigator:** Susan Fullerton (PI)

**Amount:** \$50,000 over 2 years

**Source:** AAAS Marion Milligan Mason Award

**Duration:** January 2019 - December 2020

**Summary:** Chemistry of monolayer electrolyte.

9. **Title:** *Holographic Assembly of Reconfigurable Nanoscale Plasmonic and Photonic Elements*

**Investigators:** Paul Bohn (PI), David Go (co-PI), Greg Timp (co-PI), Ryan Roeder (co-PI), Susan Fullerton (co-PI), Anthony Hoffman (co-PI)

**Amount:** \$900,000 (Fullerton lab: \$150,000)

**Source:** DARPA Atoms to Products (A2P)

**Duration:** May 2015 - April 2018

**Summary:** Demonstrate a metamaterial with reconfigurable optical properties

**Fullerton's role:** Development of polymer electrolyte and detailed study of filament formation and dissolution kinetics

10. **Title:** *GOALI: A low-voltage nonvolatile single transistor flash memory device based on ion transport in 2D electrolytes*

**Investigators:** Susan Fullerton (PI), Alan Seabaugh (co-PI)

**Amount:** \$368,388 over 3 years

**Source:** NSF-ECCS

**Duration:** July 2014 - June 2017

**Summary:** Demonstrate a flash memory based on two-dimensional (2D) materials

**Fullerton's role:** Invention and development of monolayer electrolyte and device fabrication and electrical measurement

11. **Title:** *Center for Low Energy Systems Technology (LEAST)*

**Investigators:** Alan Seabaugh (PI), Susan Fullerton (co-PI) + 27 co-PIs

**Amount:** \$29,860,355 (Fullerton lab: \$1,150,059)

**Source:** SRC-DARPA Focus Center Research Program (FCRP)

**Duration:** January 2013 - October 2017

**Summary:** A microelectronics center focused on the development of low-energy devices for logic and memory

**Fullerton's role:** Develop ion gating strategies to demonstrate steep subthreshold swing in beyond CMOS transistors, and steep switching for next-generation memory.

**12. Title:** *Neutron scattering at ORNL to characterize the structure of poly(trimethylene glycol)/water*

**Investigators:** Susan Fullerton

**Amount:** \$10,000      **Source:** ORAU Ralph E. Powe Junior Faculty Enhancement Award

**Duration:** June 2016 - May 2017

**13. Title:** *Development of Materials for Improved Secondary Battery Technology*

**Investigators** Paul McGinn (PI), Joan Brennecke (co-PI), **Susan Fullerton (co-PI)**, Prashant Kamat (co-PI), Ed Maginn (co-PI), Alan Seabaugh (co-PI)

**Source** Department of Defense, U.S. Army, TARDEC

**Amount:** \$1,386,000 over 3 years (Fullerton lab: \$160,000)

**Duration** August 2010 - November 2013

**Summary:**Development of new materials and models for battery technology

**Fullerton's role:** Experimental design, electrolyte/nanoparticle preparation, and electrical measurements to study how nanoparticle aspect ratio affects ionic conductivity of polymer electrolytes

## OTHER RESEARCH FUNDING

### Completed Research Support

**14. Title:** *Tuning polymer architecture to enable tamper resistant electronics*

**Investigators:** Susan Fullerton and Jenny Laaser (Chemistry)

**Amount:** \$20,000 (Fullerton lab: \$10,000)

**Source:** U. of Pittsburgh Chemistry/SSOE

**Duration:** March 2018 - March 2019

**Summary:** To create transient electronics for which the lifetime of the device can be tuned by tuning the molecular properties of the polymers.

**Fullerton's role:** Device design, fabrication and electrical measurements using the polymer electrolytes synthesized by Laaser.

**15. Title:** *New Polymer Electrolyte by Hyperbranched Polymer Assembly for Rechargeable Lithium-Ion Batteries*

**Investigators:** Y. Elaine Zhu (PI), **Susan Fullerton (co-PI)**, Haifeng Gao (co-PI)

**Amount:** \$99,808 (Fullerton lab: \$25,000)

**Source:** U. Notre Dame Sustainable Energy Initiative

**Duration:** April 2014 - April 2015

**Summary:** A new polymer architecture for potential use as a battery electrolyte

**Fullerton's role:** Experimental design, electrolyte preparation, and electrical measurements of new polymers synthesized by co-PI Gao

## E. CONTRIBUTIONS TO TEACHING

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### 1. Courses Taught at the University of Pittsburgh

*Advanced Transport Phenomena* (required graduate course) ChE 2301 - Fall 2020, 2021, 2022

*Credits:* 4 (Four contact hours/week)

*Description:* Graduate-level momentum, mass and heat transfer

*OMET score, term (number of students):*

3.67/5, Fall 2020\* (26); 4.5/5, Fall 2021 (9); 4.3/5 Fall 2022 (10)

\*Taught remotely under COVID for first several weeks, then in hybrid mode.

*Transport Phenomena* (required undergraduate course) ChE 300 - Fall 2016, 2017, 2018, 2019

*Credits:* 6 (Eight contact hours/week)

*Description:* combines all three modes of transport - momentum, mass and heat - in one course.

*OMET score, term (number of students):*

4.67/5, Fall 2016 (70); 4.63/5, Fall 2017 (64); 4.67/5, Fall 2018 (60); 4.53/5, Fall 2019 (66)

## 2. Classroom innovations introduced at the University of Pittsburgh

*Active learning*

- Established Pitt as a site for NSF-funded Desktop Learning Modules for fluid dynamics and heat transfer; PI: Bernard Van Wie; Washington State University; Deployed the hands-on modules during Fall 2020 (both virtually and in-person) to Graduate Transport (ChE 2301) and both sections of Undergrad Transport (ChE 300).

- First in the department to introduce Top Hat (electronic response tool)

- Prepared in-class and video recorded demonstrations to convey concepts

*Group work, Evaluation and Assessment, Societal Impacts*

- Group heat exchanger project; used CATME to assign groups and acquire peer feedback

- Weekly formative assessment: used Top Hat to collect student feedback on “muddy” and “clear” concepts; addressed “muddy” concepts in the next lecture.

- Evaluated ecological impacts of cooling water discharge into rivers

## 3. Contributions to non-classroom teaching

*Undergraduate Research*

**University of Pittsburgh:** 13 undergrads

**First-authored Publication:**

Aaron Woeppel; *ACS Applied Materials & Interfaces* 2020; Paper 50

**Co-authored Publications:**

Abigale Gray; *Advanced Functional Materials* 2019, Paper 41

Blaec Toncini; *Advanced Materials Interfaces* 2018; Paper 33

**Award:** Matei Jordache - 1<sup>st</sup> place in the OXE Undergraduate research poster competition; Pitt ChE research day; 2/20/18

**University of Notre Dame:** 10 undergrads and 2 high school students

**First-authored Publication:**

Suong Do; *Journal of Physical Chemistry C.*, 2012; Paper 6

Dean Schaetzl; *Journal of Physical Chemistry C.*, 2014; Paper 8

## F. PERSONNEL SUPERVISED

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### Visiting Research Professors

**1. Ke Xu, Ph.D.**

*August 2014 - August 2021*

University of Pittsburgh, ChE

Project: “Ion gating for low voltage electronic devices.”

Support: SRC/DARPA (LEAST); NSF-DMR-EPM

Current position: Tenure-track Assistant Professor in the School of Physics and Astronomy and in Microsystems Engineering at Rochester Institute of Technology

**2. Huilong Xu, Ph.D.**

*August 2013 - August 2014*

University of Notre Dame, EE

Project: “Electrostatic doping of 2D materials for memory and TFETs”  
Support: SRC/DARPA (LEAST)

## Postdoctoral Scholars

**1. Huamin Li, Ph.D** (*co-Advised with Alan Seabaugh, EE*) *May 2014 - March 2015*

University of Notre Dame, EE

Project: “Electric double layer dynamics studied on graphene FETs”

Support: SRC/DARPA (LEAST)

**2. Benxin Jing, Ph.D** (*co-advised with Elaine Zhu, ChE*) *April 2014 - April 2015*

University of Notre Dame, ChE

Project: “New Polymer Electrolyte by Hyperbranched Polymer Assembly for Rechargeable Li-ion batteries.”

Support: Notre Dame internal grant

## PhD Students

**Summary:** Completed PhDs: 3 as sole advisor, 1 as co-advisor.

In progress at Pitt: 5 as sole advisor

**1. Erich Kinder** *January 2013 - June 2017*

PhD Student, University of Notre Dame, EE

Dissertation: “Gating of two-dimensional materials using solid polymer electrolytes and ferroelectrics”

Defense date: 6/23/2017

Support: SRC/DARPA (LEAST)

Awards:

1. 3<sup>rd</sup> place prize of \$225 at the IEEE mini-symposium on Electron Devices and Photonics, Notre Dame, IN. January 2015
  2. \$3,000 NSF Travel Award to the 11th International Nanotechnology Conference on Communication and Cooperation, Hilton Sea Hawk, Fukouka-city, Fukouka, Japan *May 11-13, 2015*.
- Current employer: Texas Instruments

**2. Hao Lu (F)** (*co-advised with Alan Seabaugh, EE*) *July 2014 - October 2016*

PhD Student, University of Notre Dame, EE

Dissertation: “Development of Nanometer Ion Conductor for 2D-Crystal Memory and Universal Tunnel Transistor SPICE Model.”

Defense date: 10/3/2016

Support: SRC/DARPA (LEAST), NSF-ECCS/GOALI

Current employer: Facebook

**3. Jierui (Jerry) Liang** *October 2015 - November 2020*

PhD Student, University of Pittsburgh, ChE

Dissertation: “Ion-Controlled Electronics Enabled by Electric Double Layer Gating of Two-Dimensional Materials”

Defense date: 10/29/2020

Support: NSF, PQI Award

Awards:

1. Pittsburgh Quantum Institute’s Science 2019 “veteran” poster session award
2. Pittsburgh Quantum Institute’s Graduate Student Award (support for Fall 2019)
3. Pittsburgh Quantum Institute’s Science 2016 and 2017 poster session grand prize

*Note: Jerry won the grand prize of a \$1,000 travel award and an iPad two consecutive years*

**4. Zhongmou Chao** *October 2015 - November 2020*

PhD Student, University of Pittsburgh, ChE  
Dissertation: “Silver Filament Formation and Dissolution Dynamics Through a Polymer - Ionic Liquid Composite by Direct Write”  
Defense date: 10/28/2020  
Support: DARPA Atoms to Products and the PPG Foundation; Start-up  
Awards:

1. PPG Graduate Research Fellowship for “Polymer coatings with reconfigurable optical properties.” (\$20k), 2018
2. Best paper award; Dept. of Chemical and Petroleum Engineering (\$500) 2018
3. PQI Travel award for best poster presentation at 2019 annual conference (\$1,000) 2019

**5. Shubham Awate**

*November 2018 - present*

PhD Student, University of Pittsburgh, ChE  
Expected graduation: 2023  
Project: “Nanoionic 2D crystal memory”  
Support: NSF, AAAS  
Awards:

1. Pittsburgh Quantum Institute’s “Science 2019” Travel Award (\$1,000)
2. Pittsburgh Quantum Institute’s 2020 Veteran Poster Award
3. 1<sup>st</sup> Place Oral Presentation at the Seventh Annual OXE and Chemical and Petroleum
4. Pittsburgh Quantum Institute Fellowship - one semester of GSR support (Spring 2023) Engineering Research Day, U. of Pittsburgh (\$300)

**6. Huiran (Henry) Wang**

*December 2019 - present*

PhD Student, University of Pittsburgh, ChE  
Expected graduation: 2024  
Project: “Monolayer electrolyte for 2D crystal memory”  
Support: NSF-DMR-EPM CAREER  
Awards:

1. Poster Award (1 of 3 winners): EL04 Graphene and Beyond Symposium; Materials Research Society (MRS) Fall 2020 Virtual Meeting (\$200)
2. Pittsburgh Quantum Institute’s 2020 Poster Presentation Award (virtual) (\$500)

**7. Nader Majet Sawtarie**

*December 2020 - present*

PhD Student, University of Pittsburgh, ChE  
Expected graduation: 2025  
Project: “Modulating optical and electronic properties of 2D metals using EDL gating”  
Support: NSF-DMR MRSEC

**8. Priscilla Prem**

*November 2021 - present*

PhD Student, University of Pittsburgh, ChE  
Expected graduation: 2026  
Project: “Design and synthesis of ion-locked polymer electrolytes for hardware security”  
Support: NSF-ECCS-EPMD Awards:  
DoD SMART Fellowship (Prem declined this award due to a the requirement of a long postdoctoral commitment to the DoD)

**9. Dnyanesh Deepak Sarawate**

*November 2021 - present*

PhD Student, University of Pittsburgh, ChE  
Expected graduation: 2026  
Project: “Ion-locked polymer electrolytes for hardware security”



Support: NSF-ECCS-EPMD

## MS Students

**1. Sandhya Vasudevan (F)** *June 2014 - May 2016*

MS Student, University of Notre Dame, EE

MS Thesis: "The effect of nanoparticle shape on conductivity in solid polymer electrolytes."

Defense date: 5/19/2016

Support: N/A

Current employer: Completed PhD in EE at Notre Dame 2020

**2. Ziwei Guo** *November 2015 - April 2017*

MS Student, University of Pittsburgh, ChE

MS Thesis: "Electrolyte Gating of TIPS-Pentacene and Graphene Field Effect Transistors"

Defense Date: 4/31/2017

Support: N/A

Current employer: Cloud Clean Biological Technology Co. Ltd.

**3. Micah (Eli) Bostian (co-advised with Prof. James McKone)** *January 2018 - July 2020*

MS Student, University of Pittsburgh, ChE

MS Thesis: "Exploring Electrochemical Reactivity in Ionically-Gated Field-Effect Transistors"

Defense Date: 7/15/2020

Support: NSF-DMR-EPM

Current employer:

## Undergraduate Researchers

**1. Sarah Schubert (F)** *May 2010 - August 2010*

University of Notre Dame, Chemistry

Project: "Preparing a solid-state quantum-dot sensitized rainbow solar cell with polymer nanoparticles"

Support: NDnano

**2. Dean Schaetzl** *Spring 2011 - Summer 2013*

Purdue University South Bend, EET

Project: "Aligning conductive pathways in solid polymer electrolytes for lithium-ion batteries"

Support: NDnano

**3. Nhu Suong Do (F)** *Spring 2011 - Spring 2013*

University of Notre Dame & Saint Mary's College, EE & Math

Project: "Effect of nano-filler shape on the conductivity of solid polymer electrolytes (SPEs) for rechargeable lithium-ion batteries"

Support: NDnano

**4. Josh Vahala (co-advised with Alan Seabaugh, EE)** *May 2012 - December 2013*

University of Notre Dame, EE

Project: "Electrical characterization of ion transport in planar graphene/PEO:LiClO<sub>4</sub>/graphene structures"

Support: NDnano

**5. Samuel Leung (co-advised with Alan Seabaugh, EE)** *May 2012 - August 2012*

University of Notre Dame, ChE

Project: "Ion Transport in a Solid Polymer Electrolyte Between 2-D Graphene Surfaces"

Support: NDnano

**6. Buchanan Bourdon**

*May 2013 - December 2014*

University of Notre Dame, EE

Project: “Modeling ion-electron transport in 2D materials”

Support: NDnano

**7. Katie O’Neill (F)**

*May 2014 - August 2014*

Trinity College, Dublin, Ireland

Project: “Characterizing 2D electrolytes for ion-graphene memory.”

Support: NDnano

**8. Ashley Fuller (F)**

*May 2015 - August 2015*

University of Notre Dame, Chem/ChE

“PVA-based electrolytes for ionic gating”

Support: NDnano

**9. Edward Hunckler**

*May 2015 - August 2015*

University of Notre Dame, EE

Project: “CO<sub>2</sub> cleaning of 2D crystal surfaces”

Support: NSF REU supplement (GOALI)

**10. Rachel Buck (F)**

*May 2016- August 2016*

University of Minnesota Duluth, ChE

Project: “Physical Characterization of Electrolytes for Reconfigurable Nanoscale Elements”

Support: NSF REU site; U. of Pittsburgh, Chem. Eng. (summer 2016)

**11. Blaec Toncini**

*January 2016 - August 2016*

University of Pittsburgh, ChE

Project: “Development of Processes for Cleaning Resist from 2D Crystal Surfaces”

Support: NSF-ECCS/GOALI REU (summer 2016)

**12. Celina Celmo (F)**

*Summer 2017*

University of Pittsburgh, ChE

Project: “Observing polymer crystallization with an ipone”

Support: N/A

**13. Matei Jordache**

*January 2017 - December 2017*

University of Pittsburgh, ChE

Project: “AFM Characterization of exfoliated MoS<sub>2</sub> and monolayer electrolyte”

Support: NSF-DMR-ECCS REU supplement

**14. Brian Radka**

*January 2017 - December 2017*

University of Pittsburgh, ChE

Project: “Filament formation/dissolution kinetics in a polymer/ionic liquid film ”

Support: Start-up

**15. Aaron Woepfel**

*September 2017 - present*

University of Pittsburgh, ChE

Project: “Modeling the field-strain relationship in ionomers”

Support: SSOE Undergraduate Research Award (Summer 2018)

- 16. Jeirus Jose** *Summer 2018*  
 San Francisco State University  
 Project: “Electrical properties of doubly-polymerized ionic liquids”  
 Support: NSF REU site; U. of Pittsburgh, Chem. Eng.
- 17. Alvin Fersner (URM)** *Summer 2018*  
 University of South Carolina  
 Project: “Silica deposition by PECVD and sputtering on hygroscopic polymers”  
 Support: NSF REU site; U. of Pittsburgh, Chem. Eng.
- 18. Logan Kutzer** *Fall 2018*  
 University of Pittsburgh, ChE  
 Project: “A new approach to recyclable materials ”  
 Support: N/A
- 19. Noah Sakmar** *Spring 2019*  
 University of Pittsburgh, ChE  
 Project: “New materials for recycling”  
 Support: N/A
- 20. Abigale Gray (F)** *Spring 2019*  
 University of Pittsburgh, ChE  
 Project: “Nano-scale filament formation/dissolution dynamics in solid electrolytes ”  
 Support: N/A
- 21. Samantha Bunke (F)** *Spring 2019 - Summer 2019*  
 University of Pittsburgh, ChE  
 Project: “A new approach to recyclable materials ”  
 Support: SSOE Undergraduate Research Award (Summer 2019)
- 22. Jonathan Bingaman** *January 2020 - December 2020*  
 University of Pittsburgh, ChE  
 Project: “Recycling the Unrecyclable”  
 Support: N/A
- 23. Brendan Mostek** *Spring 2020 - present*  
 University of Pittsburgh, ChE  
 Project: “Coupling ion-electron transport in ion-gated field-effect transistors using COMSOL Multiphysics”  
 Support: N/A
- 24. Andrew Ashmar** *Fall 2021 - present*  
 University of Pittsburgh, ChE  
 Project: “Gradient materials for sustainable packaging”  
 Support: N/A
- 25. Anna Workosky (F)** *Summer 2022 - present*  
 University of Pittsburgh, ChE  
 Project: “Quantifying triggerable dissolution of crosslinked alginate”  
 Support: N/A
- 26. Marlene Mendez (F)** *Summer 2022*

University of Pittsburgh, ChE  
Project: "Impact of salt concentration and electrolyte thickness on electric-double layer gating"  
Support: NSF REU

### High School Students

**1. Kiersten Lieurance (F)** *September 2013 - January 2014*

Marian High School, Mishawaka

Project: "Electrical Characterization of PEO:LiClO<sub>4</sub> as a Function of Humidity"

Support: NDnano

**2. Melissa Cunningham (F)** *Fall 2011 - Spring 2011*

Marian High School, Mishawaka

Project: "New materials for flexible batteries"

3rd Place in EE category at the 2011 Northern Indiana Regional Science and Engineering Fair

Support: NDnano

### G. HONORS AND AWARDS

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Sloan Research Fellowship in Chemistry,  
The Alfred P. Sloan Foundation (\$75,000) *2020*

The Marion Milligan Mason Award for Women in the Chemical Sciences,  
American Association for the Advancement of Science (AAAS) (\$50,000) *2019*

NSF CAREER Award (DMR-EPM) (\$540,000) *2018*

James Pommersheim Award for Excellence in Teaching,  
Department of Chemical and Petroleum Engineering, University of Pittsburgh *2018*

The Ralph E. Powe Junior Faculty Enhancement award, ORAU (\$10,000) *2016*

The Frank J. Padden Jr. Award for "*Excellence in Polymer Physics Research*"  
The American Physical Society *2009*

General Electric - First Year Faculty for the Future Fellowship in Engineering (\$10,000) *2007*

Outstanding Research Presentation: The Larry Duda Award for Outstanding Graduate Student  
Performance in Chemical Engineering, sponsored by Arkema, Inc. (\$3000) *2006*

Outstanding Teaching Assistant Award: The Walter R. and Aura Lee Supina  
Graduate Fellowship in Chemical Engineering (\$2000) *2004*

National Science Foundation Graduate Research Fellowship *2004-2007*

The Arthur and Elizabeth Rose Memorial Graduate Fellowship in  
Chemical Engineering (\$5000) *2003*

Marie Underhill Noll Graduate Fellowship in Engineering (\$2500) *2003*

General Electric - Faculty for the Future Fellowship  
in Engineering (\$5000) *2003*

Paul Morrow Endowed Scholarship in Engineering (\$4000) *1998*

James H. Lum Scholarship in Engineering (\$4000) *1998*

Travel Award to the Eighth International Conference on Quasi-Elastic Neutron Scattering  
Bloomington Convention Center, Bloomington, IN USA *June 14-17, 2006*

Travel Award to the Spallation Neutron Source - High Flux Isotope Reactor Users Meeting  
Oak Ridge National Laboratory, Oak Ridge, TN USA *October 11-13, 2005*

Travel Award to Methods and Applications of Neutron Spectroscopy  
NIST Center for Neutron Research, Gaithersburg, MD USA *June 20-24, 2005*

## H. PROFESSIONAL SERVICE AND LEADERSHIP ACTIVITIES

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### University Service

- Quantum Theory Advisory Committee (Invited, 2021 - present);  
Chair - Senior Vice Chancellor for Research, Rob Rutenbar
- 2021 Search Committee for Quantum Theory Faculty Position; Chair Prof. Jeremy Levy
- 2018 University of Pittsburgh Provost Search Committee
  - elected by faculty members of the Professional schools
  - position filled by Prof. Ann Cudd
- Panel member at 2018 Women in STEM conference (University of Pittsburgh)
- Goldwater Undergraduate Scholarship selection committee, Fall 2015

### SSOE Service

- 2017 Swanson School of Engineering Dean's Search Committee
  - elected by the SSOE Assistant Professors
  - position filled by Prof. James Martin II
- Faculty Advisor to the Nanotechnology Student Club 2017 - 2019
- Guest Lecturer for Eng. 3000 (Prof. April Dukes) on landing a faculty position, March 2019, 2020
- Panelist for SSOE "Creating a Strong Promotion and Tenure Package", April 2021

### Department Service

- Vice Chair for Graduate Education May 2020 - present
- Graduate admissions committee Chemical Engineering 2015 - 2019
- TS Faculty search committee Chemical Engineering
  - 2017/2018 position filled by Prof. Tagbo Niepa
  - 2018/2019, filled the position, but applicant withdrew after accepting the offer
- Co-coordinator of Chemical and Petroleum Engineering seminar series 2016-2019  
organize networking lunches between women seminar speakers and graduate students (ongoing)

### Thesis Committees

- University of Pittsburgh

#### MS

- Victor Manrique: ChE (Li), MS completed 2016 (committee member)
- Ziwei Guo: ChE (Fullerton), MS completed 2016 (advisor)
- Aayush Mantri: ChE (McKone), MS completed April 2018 (committee member)
- Micah (Eli) Bostian: ChE, (Fullerton/McKone) MS completed 2020 (co-advisor)
- Qiudi Meng: ChE (McKone), MS completed 2019 (committee member)
- Chris Parker: ChE (Veser), MS completed Fall 2021 (committee member)
- Zach Parr: ChE (McKone), MS completed summer 2022 (committee member)

#### PhD

- Amey More: ChE (Veser), PhD completed 2016 (committee member)
- Jiaqi Zhao: ChE (Li), PhD completed 2018 (committee member)
- Jenna Gustafson: ChE (Wilmer), PhD completed 2019 (committee member)
- Daniel Bolt: Chem (Dennis Curran), PhD completed 2019 (committee member)
- Kutay Sezginel: ChE (Wilmer), PhD completed December 2019 (committee member)
- Quing Guo: Physics (Levy), PhD completed May 2020 (committee member)
- Daniel Burrill: Chemistry (Lambrecht), PhD completed April 2020 (committee member)

- Tejal Sawant: ChE (McKone), PhD completed December 2020 (committee member)
- Zhongmou Chao: ChE (Fullerton), PhD completed 2020 (advisor)
- Carli Judith Kelsheimer: Chemistry (Garrett-Roe), PhD completed 2021 (committee member)
- Jierui (Jerry) Liang: ChE (Fullerton), PhD completed 2021 (advisor)
- Bingchen Wang: ChE (Li), PhD completed Spring 2021 (committee member)
- Emily Ackerman: ChE (Shoemaker), PhD completed summer 2021 (committee member)
- Erin Sheridan: Physics (Levy), PhD completed Fall 2021 (committee member)
- Pinlei Lu: Physics (Hatridge), PhD completed Spring 2022 (committee member)
- John Erickson: Electrical Eng (Feng Xiong), PhD completed Spring 2022 (committee member)
- Schichao Jiao: ChE (McCarthy), PhD expected 2022 (committee member)
- Brian Day: ChE (Wilmer), PhD completed summer 2022 (committee member)
- Evan Richards: ChE (Federspiel), PhD expected 2023 (committee member)
- Shubham Awate: ChE (Fullerton), PhD expected 2023 (advisor)
- Huiran (Henry) Wang: ChE (Fullerton), PhD expected 2024 (advisor)
- Fan Yan: ChE (Lei), PhD expected 2024 (committee member)
- Nader Sawtarie: ChE (Fullerton), PhD expected 2025 (advisor)
- Priscilla Prem: ChE (Fullerton), PhD expected 2026 (advisor)
- Dnyanesh Sarawate: ChE (Fullerton), PhD expected 2025 (advisor)
- Melanie Dieterlen: Physics (Levy), PhD expected 2025 (committee member)
- Yihan Song: ChE (Li), PhD expected 2025 (committee member)

- University of Notre Dame

- Hao Lu (Fullerton), EE, PhD completed 2016 (co-advisor)
- Eric Kinder, EE (Fullerton), PhD completed 2017 (advisor)
- Sandhya Vasudevan (Fullerton), EE, MS completed 2017 (advisor)
- Sara Fathipour: EE (Seabaugh), PhD completed 2017 (committee member)
- Garrison Crouch(Seabaugh): ChE, PhD completed 2019 (committee member)
- Mina Asghari Heidarlou (Seabaugh): EE, PhD completed 2019(committee member)
- Paolo Paletti (Seabaugh): EE, PhD completed 2019 (committee member)
- Karla Gonzalez (Seabaugh): EE, PhD expected 2020 (committee member)

- Carnegie Mellon University

- Dacen Waters, Physics, PhD expected August 2020 (committee member)

- Penn State University

- Shruti Subramanian (Robinson), MATSE, PhD completed April 2020 (committee member)

### University Institute Service

- Pittsburgh Quantum Institute (PQI) Executive Committee Member, Summer 2017 - present
- Poster judge for PQI 2016, 2018, 2019, 2020, 2022     • Poster judging organizer for PQI 2022

### Positions of Leadership

- General Arrangements Chair
  - 2018 Annual meeting of the the American Institute of Chemical Engineers (AIChE), Pittsburgh, PA
- Lead Symposium Organizer\*
  - Fall 2020 Materials Research Society (MRS) Meeting, Virtual  
*Symposium:* “Beyond Graphene 2D Materials— Synthesis, Properties, and Device Applications” Co-organizers: Zak Al Balushi, Tania Roy, Jieun Lee  
*Workshop:* organized and led (virtually) a workshop on “2D Layered Materials for Quantum”; Speakers Jeanie Lau (Ohio State), Nitin Samarth (Penn State), Nai-Chang Yeh (Caltech)  
 \*Note that Fullerton and her co-organizers first organized this symposium (which was the

largest at the conference) for in-person attendance and then reorganized it for virtual.

### **K-12 Outreach**

- Materials Science Summer Camp, St. Joseph High School (Summer 2017);  
Demonstration of polymer crystallization using iphone
- New Brighton Elementary school (Fall 2017);  
Demonstration of polymer crystallization using iphone
- Materials Science and Technology Conference (Fall 2017);  
Poster presentations and demonstration of polymer crystallization using iphone
- Buffalo Elementary School, Sarver PA (Spring 2019);  
Active learning about solid/liquids/gases and polymers; Mrs Ortlip - Kindergarten
- PQI High School outreach (Spring 2019, Spring 2021 - virtual)  
Served as a panelist and gave a tour of my lab.
- Buffalo Elementary School, Sarver PA (Spring 2020);  
Active learning about solid/liquids/gases; Mrs. Miller - Grade 1
- Keystone Oaks High School, Pittsburgh PA (Spring 2021 - virtual);  
Gave a presentation on careers in Chemical Engineering;  
Contact: Heather Scanlon - Career Readiness Advisor
- New Brighton Elementary school (March 17, 2022);  
Solids, Liquids, Gases and Demonstration of polymer crystallization using handheld microscope;  
donated 40 microscopes to the school from NSF CAREER grant
- Roy A. Hunt Elementary School, New Kensington, PA (December 7 - 8, 2022);  
Arranged for the ChE Graduate Student Association to complete 5, hands-on materials-focused demos to the entire 6th grad class over two mornings (totaling about 75 students). Annabelle Lint (Pitt, ChE) was the lead graduate student. The Fullerton group demo focused on polymer crystallization using handheld microscopes; we donated 50 of them - NSF CAREER.  
Contact: Brad Farineau - 6th grad teacher

### **Federal Review Panels and Invited Meeting Participant**

- NSF Panel Review (March 2015, March 2016, March 2019 (remote), March 2019, January 2021 (remote), September 2021 (remote), September 2022 (remote))
- NSF-Sponsored US-EU Workshop on 2D Materials and Devices (by invitation only)  
(April 2015; October 2017; September 2018; May 2019)

### **Editorial Board**

- *July 2019 - present: npj 2D Materials and Applications (Nature Partner Journal)*

### **Elected Conference Committee Member**

- *2020 - 2023: Electronic Materials Conference, 3 year term*

### **Invited Organizer**

- *2015 - 2020: Electronic Materials Conference*  
Topics: (1) Materials for Memory and Computation, (2) Graphene BN, MoS<sub>2</sub> and other 2D Materials and Devices

### **Session Chair**

- 2015 Electronic Materials Conference, Session K: Materials for Memory and Computation, Ohio State University, Columbus, OH, June 24, 2015
- 2016 Electronic Materials Conference, Session AA: Impact of Surface Interactions on 2D Devices, University of Delaware, Newark, DE, June 23, 2016
- 2017 Electronic Materials Conference, Session S: BN, BP, TMD and Novel 2D Materials, University of Notre Dame, Notre Dame, IN, June 29, 2017
- 2018 Electronic Materials Conference, Session OO: Emerging 2D Materials and Phenomena,

- University of California at Santa Barbara, Santa Barbara, CA, June 29, 2018
- 2019 Electronic Materials Conference, SESSION C: 2D Growth and Characterization, University of Michigan, Ann Arbor, MI, June 26, 2019
- 2019 Materials Research Society (MRS) Meeting, Session FF01.05: Advances in 2D Memory and Transistor Architecture Boston, MA, December 2, 2019
- 2021 Electronic Materials Conference, Session DD: Materials for Memory and Logic Conference held online due to COVID, June 25, 2021
- 2022 Materials Research Society (MRS) Meeting, NM01 Beyond Graphene 2D Materials—Synthesis, Properties and Device Applications Honolulu, HI, May 10, 2022

### **Journal and Proposal Reviewer**

2D Materials, ACS Applied Materials and Interfaces, ACS Applied Polymer Materials, ACS Nano, Advanced Electronics, Advanced Materials, Advanced Functional Materials, Applied Physics Letters, Applied Physics Reviews, Beamtime Proposals at the NIST Center for Neutron Research (NCNR), Chemistry of Materials, Chem. Electro. Chem., Department of Energy Proposal, IEEE Transactions on Electron Devices, Ionics, Journal of Materials Chemistry A Journal of Vacuum Science and Technology Langmuir, Macromolecules, Materials Communications Materials Science and Engineering B, Materials Science in Semiconductor Processing, Membranes, Nature, Nano Research, Nano Letters, Nanoscale, Nature Communications, PLOS One, Soft Matter, Scientific Reports, Science Advances, The Journal of Physical Chemistry, The Journal of Physical Chemistry Letters, The Journal of Polymer Science B.

## **I. CONTRIBUTIONS TO DIVERSITY**

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- Approximately 35% of the students who have completed or are currently completing research projects in my lab are women (14/40)  
PhD: Hao Lu, Priscilla Prem. MS: Sandhya Vasudevan. Undergrads: Marlene Mendez, Anna Workosky, Sammantha Bunke, Abigail Gray, Rachel Buck, Ashley Fuller, Katie O'Neill, Nhu Suong Do, Sarah Schubert, High School: Kiersten Lieurance, Melissa Cunningham
- Non-technical, invited presentation on “The Imposter Syndrome and Work/Life Balance” in celebration of Pitt’s “Year of Diversity” has been viewed on YouTube more than 590 times and presented live to approximately 400+ students via ChE Undergraduate Seminar Series 2017, 2019, 2022, SWE 2017, 2022 conferences, SSOE GWEN Luncheon, SSOE EGSO, Department of Neurology, Penn State, ChE NSF REU 2019, 2022, etc.
- Served on one Faculty search committee, one Dean’s search committee, and one Provost’s search committee (see details in section H) with women and URM candidates hired in each case (Provost Anne Cudd, Dean James Martin, Prof. Tabgo Niepa.)
- Invited by the conference organizers to lead the Gordon Research Conference (GRC) “Power Hour” (Two-Dimensional Electronics Beyond Graphene, June 2022). The topic I chose was non-promotable tasks, which disproportionally impact women and underrepresented groups, as described in the book “The no club: Putting a stop to women’s dead-end work” by Lise Vesterlund (U. Pitt), Linda Babcock, Brenda Peyser, and Laurie Weingart (CMU).

## **J. PROFESSIONAL DEVELOPMENT**

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-*Writing Winning Grant Proposals: a two-day workshop by Dr. John Robertson of the Grant Writers’ Seminars and Workshops LLC.* Organized by the Center for Faculty Excellence, Swanson School of Engineering; April 8<sup>th</sup> - 9<sup>th</sup>, 2015.

-*How to Engineer Engineering Education? A two-day workshop by Prof. Michael Prince, Bucknell University.* Organized by the Swanson School of Engineering; July 13<sup>th</sup> - 14<sup>th</sup>, 2016; June 8<sup>th</sup>, 2018.



-*Leadership development, networking, singletasking: a two-day workshop by Devora Zack, MBA, of Only Connect Consulting, Inc.*; Organized by the Center for Faculty Excellence, Swanson School of Engineering; May 15<sup>th</sup> - 16<sup>th</sup>, 2017.

-*Alan Alda Science Communication Workshop*; Organized by the Swanson School of Engineering; June 12<sup>th</sup> - 13<sup>th</sup>, 2017.

-*Leading and managing your group: a two-day workshop by Devora Zack, MBA, of Only Connect Consulting, Inc.*; Organized by the Center for Faculty Excellence, Swanson School of Engineering; July 25<sup>th</sup> - 26<sup>th</sup>, 2019.

-*Individual Professional Coaching by Devora Zack, MBA, of Only Connect Consulting, Inc.*; Organized by the Center for Faculty Excellence and partially supported by the Swanson School of Engineering; Fall 2021 - Summer 2022.

## K. PROFESSIONAL AFFILIATIONS

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### *Current*

- American Institute of Chemical Engineers [AIChE]
- Materials Research Society [MRS]

### *Prior*

- American Chemical Society [ACS]
- American Physical Society [APS]
- Electrochemical Society [ECS]
- Institute of Electrical and Electronics Engineers [IEEE]
- Neutron Scattering Society of America [NSSA]

## L. CONFERENCE PRESENTATIONS

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### (i) FULLERTON AS PRESENTING AUTHOR

24. Awate, S.S.; Xu, K.; Liang, J.; Mostek, B.; Muzzio, R.; Beckman, E.; Katoch, J.; Fullerton, S.K.; "Strain-induced 2H to 1T' Phase Transition in Suspended MoTe<sub>2</sub> using a Single-ion Electrolyte Gating" *Gordon Research Conference on 2D Electronics Beyond Graphene*, Southern New Hampshire University, June 2022, Manchester NH, USA. Poster

23. Liang, J.; Xu, K.; Wu, M.; Wang, W.; Cho, K., **Fullerton-Shirey, S.K.** "Molecularly Thin All-Solid-State Non-Volatile Memory Gated By a Monolayer Electrolyte" *2019 AIChE Annual Meeting* November 2019, Orlando, FL USA.

22. Liang, J.; Xu, K.; Wu, M.; Wang, W.; Cho, K., **Fullerton-Shirey, S.K.** "Molecularly Thin All-Solid-State Non-Volatile Memory Gated by a Monolayer Electrolyte" *61st Electronic Materials Conference (EMC)* June 27<sup>th</sup> 2019, Ann Arbor, MI, USA.

21. **Fullerton-Shirey, S.K.**, Xu, K.; Woepfel, A.; Bostian, M.; McKone, J.; Ding, H.; Beckman, E.; Xu, K.; "A New Approach to Accessing the Semiconductor-to-Metal Transition in Two-Dimensional Crystals Using Ionomers" *2019 MRS spring meeting* April 2019, Phoenix, AZ, USA.

20. **Fullerton-Shirey, S.K.**, Xu, K.; Guzman, D.; Islam, M.; Strachan, A.; Seabaugh, A "Pulse dynamics of electric double layers on graphene FETs" *2018 AIChE Annual Meeting* October 2018, Pittsburgh, PA, USA.

19. **Fullerton-Shirey, S.K.**, Woepfel, A.; Bostian, M.; McKone, J.; Ding, H.; Beckman, E.; Xu, K.; "A New Approach to Accessing the Semiconductor-to-Metal Transition in Two-Dimensional Crystals Using Ionomers" *60th Electronic Materials Conference* June 2018, Santa Barbara, CA, USA.

18. **Fullerton Shirey, S.K.**; Li, H.-M.; Xu, K.; Bourdon, B.; Lu, H.; Lin, Y.-C.; Guzman, D.; Islam, M.; Strahan, A.; Robinson, J.; Seabaugh, A. “Dynamics of Electric Double Layer Formation and Dissipation in Polyethylene Oxide:LiClO<sub>4</sub> on Graphene Transistors” *2017 AIChE Annual meeting*, November 2<sup>nd</sup> 2017, Minneapolis, MN, USA.
17. **Fullerton Shirey, S.K.**, Xu, K.; Lu, H.; Wang, W.; Kim, H.; Kwak, I.; Cho, K.; Kummel, A.C.; Seabaugh, A. “Electrostatic Double Layer Flash Memory Based on Two-Dimensional Crystals” *2016 AIChE Annual Meeting*, November 14<sup>th</sup> 2016, San Francisco, CA, USA.
16. **Fullerton Shirey, S.K.**, Xu, K.; Lu, H.; Wang, W.; Kim, H.; Kwak, I.; Cho, K.; Kummel, A.C.; Seabaugh, A. “Nanoionic 2D crystal memory” *Pittsburgh Quantum Institute (PQI) 2016: Quantum Challenges*, April 20<sup>th</sup> 2016, Pittsburgh, PA, USA.
15. **Fullerton-Shirey, S.K.** “Engineering the interplay between ion and electron transport for low-power transistors and memory” *Annual Meeting of the American Institute of Chemical Engineers (AIChE)* November 2015, Salt Lake City, UT, USA.
14. **Fullerton-Shirey, S.K.**; Lu, H.; Wang, W.; Kim, H.; Kwak, I.; Furuyama, T.; Kobayashi, N.; Cho, K.; Kummel, A.; Seabaugh, A. “Nanometer-thick Ion Conductors for 2D Crystal Memory” *57th Electronic Materials Conference* June 2015, Columbus, OH, USA.
13. Schaetzel, D.; Li, P.; Bernstein, G.H.; **Fullerton-Shirey, S.K.**; “Magnetic Alignment of Gamma (core)/Alpha (shell) Fe<sub>2</sub>O<sub>3</sub> Nanorods in a Solid Polymer Electrolyte” *225th ECS meeting*, May 2014, Orlando, FL, USA.
12. Schaetzel, D.; Li, P.; Bernstein, G.H.; Seabaugh, A.; **Fullerton Shirey, S.K.** “Aligning high-aspect-ratio nanofillers in solid polymer electrolytes for Li-ion batteries” *55th Electronic Materials Conference*, June 2013, Notre Dame, IN, USA, .
11. Do, N.S.; Seabaugh, A.; **Fullerton Shirey, S.K.** “Influence of nanofiller shape and aspect ratio on the ionic conductivity and thermal properties of solid polymer electrolytes for rechargeable Li-ion batteries” *55th Electronic Materials Conference*, June 2013, Notre Dame, IN, USA, .
10. Elliott, L.C.C.; Jing, B.; Akgun, B.; Zhu, Y.; Bohn, P.W.; **Fullerton Shirey, S.K.** “Small molecule drug loading and distribution in poly(N-isopropylacrylamide) brushes and its effect on the lower critical solution temperature - a neutron reflectometry and AFM study” *Materials Research Society Fall Meeting*, November 2012, Boston, MA, USA.
9. Do, N.S.; Schaetzel, D. Dey, B., Seabaugh, A.C., **Fullerton Shirey, S.K.** “Influence of Fe<sub>2</sub>O<sub>3</sub> nanofiller shape on the conductivity and thermal properties of solid polymer electrolytes: nanorods versus nanospheres” *Gordon Research Conference - Batteries*, March 2012, Ventura, CA USA. Poster.
8. **Fullerton Shirey, S.K.**; Do, S.; Schaetzel, D.; Dey, B.; Seabaugh, A.C. “Improving conductivity in solid polymer electrolytes using oxide nanorods”, *220th ECS Meeting*, October 2011. Boston, MA USA.
7. **Fullerton Shirey, S.K.**; Maranas, J.K. “The effect of LiClO<sub>4</sub> on the structure and mobility of PEO-based solid polymer electrolytes” *Frank J. Padden Jr. Award Symposium, American Physical Society* - award winner March 2009. Pittsburgh, PA USA.
6. **Fullerton, S.K.**; Maranas, J.K. “Influence of humidity and crystallization time on the ionic conductivity of nanoparticle-filled solid polymer electrolytes” *American Physical Society*, March 2007. Denver, CO USA.
5. **Fullerton, S.K.**; Maranas, J.K. “PEO mobility in solid polymer electrolytes as a function of nanoparticle concentration as measured by quasi-elastic neutron scattering” *Gordon Research Conference - Polymer Physics*, July 2006, New London, CT USA. Poster.

4. **Fullerton, S.K.**; Maranas, J.K. “PEO mobility in nanoparticle-filled polymer electrolytes as measured by neutron scattering” *American Physical Society*, March 2006. Baltimore, MD USA.
3. **Fullerton, S.K.**; Maranas, J.K. “PEO mobility in nanoparticle-filled polymer electrolytes as measured by neutron scattering” *American Institute of Chemical Engineers*, November 2005. Cincinnati, OH USA.
2. **Fullerton, S.K.**; Maranas, J.K. “Simulations of amorphous nanoparticles: the effect of shape on surface structure and subsequent interactions with the surroundings” *American Physical Society*, March 2005. Los Angeles, CA USA.
1. **Fullerton, S.K.**; Maranas, J.K. “A molecular interpretation of vitreous boron oxide dynamics” *American Institute of Chemical Engineers*, November 2003. San Francisco, CA USA.

(ii) FULLERTON AS DIRECTING AUTHOR

46. Wang, H.; Awate, S.S.; Xu, K. **Fullerton-Shirey, S.K.**; “Direct Write, Read and Erase of a Graphene/Monolayer Electrolyte/h-BN Heterostructure via Electric Force Microscopy” *Materials Research Society (MRS) Fall Meeting*, December 2nd, 2022. Boston, MA, USA.
45. Wang, H.; Awate, S.S.; Xu, K.; Fullerton-Shirey, S.K. “Monolayer electrolyte deposition with varying salt and its potential for direct write via electric force microscopy” *9th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2022, University Park, PA, USA. Poster
44. Sawtarie, N.; Awate, S.; Giebink, C.; Fullerton-Shirey, S.K. “Electric double layer gating with ultra smooth polyethylene oxide (PEO):LiClO<sub>4</sub> for optical modulation of 2D materials” *9th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2022, University Park, PA, USA. Poster
43. Sarawate, D.\*; Prem, P.\*; Liang, J.; Xu, K.; Beckman, E.; Fullerton, S.K. “Field-Controlled Ion-Locked Polymorphic Electronics for Hardware Security” *9th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2022, University Park, PA, USA. Poster  
\*Sarawate and Prem are co-presenting authors.
42. Awate, S.S.; Xu, K.; Liang, J.; Mostek, B.; Muzzio, R.; Beckman, E.; Katoch, J.; Fullerton, S.K. “Strain-induced 2H to 1T’ Phase Transition in Suspended MoTe<sub>2</sub> using a Single-ion Electrolyte Gating” *9th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2022, University Park, PA, USA. Poster
41. Awate, S.S.; Xu, K.; Liang, J.; Beckman, E.; Fullerton-Shirey, S.K. “Strain-Induced Semiconducting to Semi-Metallic Phase Transition in MoTe<sub>2</sub> Using a Single-Ion Conductor” *Materials Research Society (MRS) Spring 2022 Meeting*, May 13, 2022, Honolulu, HI, USA.
40. Awate, S.S.; Xu, K.; Liang, J.; Hunt, B.; **Fullerton-Shirey, S.K.**; “High-Speed Two-Dimensional Solid-State NonVolatile Memory Based on Electric Double Layer Gating Using a Monolayer Electrolyte” *Electronic Materials Conference (EMC)* June 2021, virtual.
39. Wang, H.; Liang, J.; Awate, S.S.; **Fullerton-Shirey, S.K.** “Impact of Salt and Solvent Identity on the Deposition of a Cobalt Crown Ether Phthalocyanine Monolayer Electrolyte” *Electronic Materials Conference (EMC)* June 2021, virtual.
38. Xu, K.; Woepfel, A.; Liang, J.; Kozhakhmetov, A.; Awate, S.; Robinson, J.; **Fullerton, S.**; “Single versus Dual Ion Conductors for Electric Double Layer Gating of Two-Dimensional Materials” *Materials Research Society (MRS) Fall 2020 Meeting*, virtual.

37. Wang, H.; Awate, S.; **Fullerton, S.K.** “Impact of Salt and Solvent Identity on the Deposition of a Cobalt Crown Ether Phthalocyanine Monolayer Electrolyte” *Materials Research Society (MRS) Fall 2020 Meeting*, virtual.
36. Chao, Z.; Xu, K.; **Fullerton-Shirey, S.K.**; “Ionic Liquid Regulated Silver Filament Formation in a Solid Polymer Electrolyte for Neuromorphic Applications” *Materials Research Society (MRS) Fall 2020 Meeting*, virtual.
35. Liang, J.; Xu, K.; Arora, S.; Laaser, J.; **Fullerton, S.** “Ion-Locking in Solid Polymer Electrolytes for Reconfigurable Gateless Electrostatic Doping” *Materials Research Society (MRS) Fall 2020 Meeting*, virtual.
34. Awate, S.; Xu, K.; Liang, J.; Hunt, B.; **Fullerton, S.** “High-Speed Two-Dimensional Solid-State Non-Volatile Memory Based on Electric Double Layer Gating with a Monolayer Electrolyte” *Materials Research Society (MRS) Spring Meeting*, Postponed because of COVID and delivered virtually Fall 2020.
33. Xu, K.; Liang, J.; Bostian, E.; Woepfel, A.; Ding, H.; Beckman, B.; **Fullerton-Shirey, S.K.**; “Electric Double Layer Gating of Two-Dimensional Field-Effect Transistors Using a Single-Ion Conductor” *Materials Research Society (MRS) Fall Meeting*, December 2nd, 2019. Boston, MA, USA.
32. Chao, Z.; Crouch, G.; Bohn, P.; Go, D.; **Fullerton Shirey, S.K.** “Tunable Silver Nanofilament Formation Dynamics in Polymer/Ionic Liquid Electrolyte Composites by Direct-Write” *Materials Research Society (MRS) Fall Meeting*, December 2nd, 2019. Boston, MA, USA.
31. Woepfel, A.;\* Xu, K.; **Fullerton, S.**; “Locally Induced Semiconductor-to-Metal Transition in Two-Dimensional Crystals Through Use of an Ionomer”, *7th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2019, University Park, PA, USA. Poster
30. Awate, S.;\* Liang, J.; Xu, K.; **Fullerton Shirey, S.K.** “Two-dimensional solid-state non-volatile memory based on electric double layer gating with a monolayer electrolyte ” *7th Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2019, University Park, PA, USA. Poster
29. Liang, J.;\* Xu, K.; Woepfel, A.; **Fullerton-Shirey, S.K.** “Electric double layer gating 2D FETs using a single-ion conductor to access the semiconductor to metal phase transition”, *2019 Graphene and Beyond: From Atoms to Applications Workshop*, Pennsylvania State University, May 2019, University Park, PA, USA. Poster.
28. Liang, J.;\* Xu, K.; Wu, M.; Hunt, B.; Wang, W.; Cho, K.; **Fullerton-Shirey, S.K.** “Solid state non-volatile memory enabled by the monolayer electrolyte”, *Pittsburgh Quantum Institute (PQI) Annual Conference*, April 2019, University of Pittsburgh, Pittsburgh, PA, USA. Poster.
27. Chao, Z.;\* Evelyn, A.; **Fullerton Shirey, S.K.** “Direct-Write Formation and Dissolution of Silver Nanofilaments in Ionic Liquid-Polymer Electrolyte Composites” *Pittsburgh Quantum Institute (PQI) Annual Conference*, April 2019, University of Pittsburgh, Pittsburgh, PA, USA. Poster.
26. Woepfel, A.;\* Xu, K.; Fullerton, S.K. “Locally Induced Semiconductor-to-Metal Transition in Two-Dimensional Crystals Through Use of an Ionomer” *Pittsburgh Quantum Institute (PQI) Annual Conference*, April 2019, University of Pittsburgh, Pittsburgh, PA, USA. Poster.
25. Liang, J.\*; Xu, K.; **Fullerton-Shirey, S.K.**, “Electric double layer gating of WSe<sub>2</sub> field-effect transistors using a monolayer electrolyte capped with h-BN”, *AICHE Annual meeting*, October 2018, Pittsburgh, PA, USA.
24. Chao, Z.; Crouch, G.; Han, D.; Bohn, P.; Go, D.; **Fullerton Shirey, S.K.** “Formation/dissolution

of silver filaments through an ionic liquid-polymer electrolyte composite” *AICHE Annual meeting*, October 2018, Pittsburgh, PA, USA. Poster

23. Woepfel, A.;\* Xu, K.; Fullerton, S. “Modeling Electric Double Layer Formation and Strain Induced by a Single-Ion Conducting Polymer on a Two-Dimensional Crystal” *AICHE Annual meeting*, October 2018, Pittsburgh, PA, USA. Poster

22. Bostian, E.;\* Xu, K.; Woepfel, A.; Ding, H.; McKone, J.; Beckman, E.; Fullerton Shirey, S.K. “Fabrication and characterization of ionomer-gated MoTe<sub>2</sub> field-effect transistors” *AICHE Annual meeting*, October 2018, Pittsburgh, PA, USA.

21. Chao, Z. ; **Fullerton-Shirey, S.K.** “Formation and dissolution of conductive silver filaments through a PEGDA/Ionic liquid thin film- Towards the development of a polymer coating with reconfigurable optical properties” *PPG Innovation Center*, Nov 2018, Allison Park, PA, USA, Oral

20. Xu, K.;\* Bostian, E.; Woepfel, A.; Liang, J.; Ding, H.; Beckman, E.; Fullerton Shirey, S.K. “Using Ions to Control Transport in Two-Dimensional Materials: A New Approach to Accessing the Semiconductor-to-metal Transition” *IEEE 13th Nanotechnology Materials & Devices Conference (NMDC 2018)*, Oct 2018, Portland, Oregon, USA.

19. Liang, J.;\* Xu, K.; Fullerton-Shirey, S.K. “Bistability in electric double layer gated WSe<sub>2</sub> field-effect transistors using monolayer electrolyte capped with h-BN”, *Pittsburgh Quantum Institute (PQI) Science 2018*, Oct 2018, University of Pittsburgh, Pittsburgh, PA, USA. Poster.

18. Xu, K.;\* Lin, Y.-C.; Robinson, J.; Guzman, D.; Strahan, A.; Seabaugh, A.; **Fullerton Shirey, S.K.** “Millisecond pulse dynamics of electric double layers formed on graphene field-effect transistors” *59<sup>th</sup> Electronic Materials Conference*, June 2017, University of Notre Dame, Notre Dame, IN, USA.

17. Liang, J.;\* Xu K.; **Fullerton Shirey, S.K.**; “Electric Double Layer Doping of WSe<sub>2</sub> Field-Effect Transistors Using a Monolayer Electrolyte” *Electrochemical Society (ECS) spring meeting* May 16<sup>th</sup> 2018, Seattle, WA, USA.

16. Liang, J.;\* Xu K.; **Fullerton Shirey, S.K.**; “Removing PMMA residue on MoS<sub>2</sub> and WSe<sub>2</sub> field effect transistors using a contact mode atomic force microscope” *Graphene and Beyond - Penn State University*, May 2018, University Park, PA, USA. Poster.

15. Chao, Z.;\* Crouch, G.; Han, D.; Bohn, P.; Go, D.; **Fullerton Shirey, S.K.** “Formation/dissolution dynamics of conductive silver filaments through an ionic liquid/ polymer electrolyte thin film” *Electrochemical Society (ECS) spring meeting* May 29<sup>th</sup> 2017, New Orleans, LA, USA.

14. Liang, J.;\* Xu K.; Jordache, M.; **Fullerton Shirey, S.K.**; “MoS<sub>2</sub> field-effect transistors gated with a monolayer electrolyte” *Electrochemical Society (ECS) spring meeting* May 29<sup>th</sup> 2017, New Orleans, LA, USA.

13. Liang, J.;\* Xu, K.; **Fullerton-Shirey, S.K.** “Deposition and characterization of monolayer electrolyte cobalt crown-ether phthalocyanine/LiClO<sub>4</sub> on MoS<sub>2</sub> FETs” *Graphene and Beyond: From Atoms to Applications - Penn State University*, May 10<sup>th</sup>, 2017, University Park, PA, USA. Poster.

12. Xu, K.;\* Lu, H.; Kinder, E.; Kummel, A.; Seabaugh, A.; **Fullerton, S.** “Ion-Doping of Graphene FETs Using a Two-Dimensional Solid-State Electrolyte” *58<sup>th</sup> Electronic Materials Conference*, June 2016, University of Delaware, Newark, DE, USA.

11. Xu, K.;\* Chu, T.; Bourdon, B.; Seabaugh, A.; Chen, Z.; **Fullerton-Shirey, S.K.** “Reconfigurable *p-n* junction formation and bandgap opening in bilayer graphene using polyethylene oxide and CsClO<sub>4</sub> solid polymer electrolyte” *Pittsburgh Quantum Institute (PQI) 2016: Quantum Challenges*, April 2016, Pittsburgh, PA USA. Poster.

10. Kinder, E.W.;\* Fuller, A.; **Fullerton, S.K.** “Room temperature static doping of 2D crystals using an ion-locking electrolyte” *MRS Spring Meeting*, March 2016, Phoenix, AZ, USA.
9. Xu, K.;;\* Chu, T.; Bourdon, B.; Seabaugh, A.; Chen, Z.; **Fullerton-Shirey, S.K.** “Reconfigurable *p-n* junction formation and bandgap opening in bilayer graphene using polyethylene oxide and CsClO<sub>4</sub> solid polymer electrolyte” *73rd Device Research Conference*, June 2015, Columbus, OH, USA. Poster.
8. Kinder, E.\* and **Fullerton, S.K.** “Ion-Locking Method for Doping Atomically-Thin Transistors” *11th International Nanotechnology Conference on Communication and Cooperation*, May 2015, Fukouka-city, Fukouka, Japan. Poster.
7. Kinder, E.\* and **Fullerton, S.K.** “PVA:LiClO<sub>4</sub>: a robust, high Tg polymer electrolyte for adjustable ion gating of 2D materials” *American Physical Society*, March 2015, San Antonio, TX, USA.
6. Li, H.-M.;;\* Bourdon, B.; Lin, Y.-C.; Robinson, J.; Seabaugh A.; **Fullerton, S.** “Dynamics of Ion-Gating 2D Crystals Using a Solid Polymer Electrolyte” *American Physical Society*, March 2015, San Antonio, TX, USA.
5. Li, H.-M.;;\* Bourdon, B.; Lin, Y.-C.; Robinson, J.; Seabaugh, A.; **Fullerton, S.K.** “Temperature dependence of ion transport in solid polymer electrolytes for electrostatic gating of 2D crystals” *The 2nd Muju International Winter School Series (MIWS2-2015)*, January 2015, Muju Deogyusan Resort, Republic of Korea. Poster.
4. Xu, H.;;\* Kinder, E.; Fathipour, S.; Seabaugh, A.; **Fullerton-Shirey, S.K.** “Reconfigurable Ion Doping in 2H-MoTe<sub>2</sub> Field-Effect Transistors Using PEO:CsClO<sub>4</sub> Electrolyte” *ISCS 2014 The 41st International Symposium on Compound Semiconductor*, May 2014, Montpellier, France.
3. Kinder, E.;;\* Lu, H.; Hwang, W.S.; Cho, B.J.; Hong, S.-K.; Seabaugh, A.; **Fullerton-Shirey, S.K.** “Field-Controlled Ion Doping of Graphene” *225th ECS meeting*, May 2014, Orlando, FL, USA.
2. Kinder, E.;;\* Yan, R.; Xing, H.; **Fullerton-Shirey, S.K.**; “Field-Effect Doping of MoS<sub>2</sub> Using a Solid Polymer Electrolyte” *225th ECS meeting*, May 2014, Orlando, FL, USA.
1. Bohn, P.;;\* Elliott, L.; **Fullerton-Shirey, S.K.** “Single Molecule Tracking as a Probe of Stimulus-Responsive Behavior in Gradient-Presenting Materials” *Fall MRS meeting*, Nov 2011, Boston, MA.

(ii). FULLERTON AS CO-AUTHOR

30. Kozhakhmetov, A.; Nasr, J.R.; Zhang, F.; Xu, K.; Briggs, N.C.; Cormier, C.R.; Addou, R.K.; Das, S.; Terrones, M.; Wallace, R.; Fullerton-Shirey, S.; Robinson, J.A. “Scalable Synthesis of BEOL compatible 2D WSe<sub>2</sub>” *61st Electronic Materials Conference (EMC)* June 27<sup>th</sup> 2019, Ann Arbor, MI, USA.
29. Subramanian, S.; Wang, Y.; Moser, S.; Xu, K.; Fullerton-Shirey, S.K.; Robinson, J.A. “Direct Visualization of the Graphene/MoS<sub>2</sub> Heterostructure Interface” *61st Electronic Materials Conference (EMC)* June 27<sup>th</sup> 2019, Ann Arbor, MI, USA.
28. Subramanian, S.;;\* Xu, K.; Deng, D.; Li, J.; **Fullerton Shirey, S.K.**; Robinson, J.A. “Tunable as-grown graphene contacts to semiconducting transition metal dichalcogenides” *4th IEEE International Conference on Emerging Electronics (ICEE)* Dec 2018, Yelahanka, Bangalore, India.
27. Zhang, K.;;\* Bersch, B.M.; Zhang, F; Briggs, N.; Xu, K.; Wang, K.; Chubarov, M; Redwing, J.M.; **Fullerton-Shirey, S.**; Terrones, M.; Robinson, J. “Sodium Chloride Induced Heterogeneities in Epitaxial MoS<sub>2</sub>” *MRS Fall Meeting*, December 2018, Boston, MA, USA.
26. Deng, D.;;\* Subramanian, S.; Zhang, K.; Perkins, K.; Xu, K.; Li, J.; Feenstra, R.M.; **Fullerton-Shirey, S.K.**; Robinson, J. “Understanding the Role of the Contact- Material Interface in a MoS<sub>2</sub>

Chemical Gas Sensor Using Directly Grown Graphene-MoS<sub>2</sub> Lateral Heterostructures” *MRS Fall Meeting*, December 2018, Boston, MA, USA.

25. Zhang, K.;\* Bersch, B.; Borys, N.; Xu, K.; Feng, S.; Joshi, J.D.; Addou, R.; Zhang, C.; Wang, K.; Wallace, R.; Cho, K.; Vora, P.; Terrones, M.; **Fullerton-Shirey, S.K.**; Schuck, P.J.; Robinson, J. “In Situ Substitutional Doping of Monolayer MoS<sub>2</sub>—The Significance of Substrates” *MRS Fall Meeting*, December 2018, Boston, MA, USA.

24. Subramanian, S.;\* Deng, D.D.; Xu, K.; Simonson, N.; Wang, K.; Li, J.; Feenstra, R.M.; **Fullerton-Shirey, R.**; Robinson, J.A. “Tunable As-Grown Graphene Contacts to Semiconducting Transition Metal Dichalcogenides” *60<sup>th</sup> Electronic Materials Conference* June 2018, Santa Barbara, CA, USA.

23. Heidarlou, M.A.;\* Jariwala, B.; Paletti, P.; Rouvimov, S.; Robinson, J.A.; **Fullerton-Shirey, S.K.**; Seabaugh, A. “Supercapacitance charge release in a CVD-grown WSe<sub>2</sub> FET incorporating PEO:CsClO<sub>4</sub> side gate” *Device Research Conference (DRC)* June 2018, Santa Barbara, CA, USA.

22. Bersch, B.;\* Lin, Y.-C.; Jariwala, B.; Xu, K.; Eichfeld, S.; Choudhury, T.; Wang, B.; Pan, Yi; Li, J.; Fölsch, S.; Feenstra, R.; Addou, R.; Haque, A.; Wallace, R.; **Fullerton, S.**; Redwing, J.; Robinson, J.; “Scalable Epitaxial Tungsten Diselenide Atomic Layers Grown via Metal Organic Chemical Vapor Deposition - Transistor Performance and Outlook” *MRS Fall meeting*, November 27<sup>th</sup>, 2017 Boston, MA, USA.

21. Fathipour, S.;\* Li, H.; Paletti, P.; Remškar, M. **Fullerton Shirey, S.K.**; Seabaugh, A.; “First synthesized WS<sub>2</sub> nanotube and nanoribbon field effect transistors grown by chemical vapor transport” *75<sup>th</sup> Device Research Conference*, June 2017, University of Notre Dame, Notre Dame, IN USA.

20. Fathipour, S.;\* Paletti, P.; Jariwala, B.; Park, J.H.; Kummel, A.; Robinson, J.; **Fullerton Shirey, S.K.**; Seabaugh, A.; “Homojunction WSe<sub>2</sub> Tunnel Field-effect Transistors” *TECHCON 2017*, September 2017, Austin, TX, USA.

19. Kummel, A.;\* Fathipour, S.; Park, J.H.; Kwak, I.; Sardashti, K. Vishwanath, S.; Xing, H.G.; **Fullerton Shirey, S.K.**; Seabaugh, A.; Movva, H.; Banerjee, S.K.; Rai, A. “Self Assembled Ordered Phthalocyanine Monolayers on 2D Semiconductors for Subnanometer Dielectric ALD Nucleation” *Pacific Rim Meeting on Electrochemical and Solid-State Science, PRIME 2016*, October 2016, Honolulu, Hawaii, USA.

18. Fathipour, S.;\* Park, J.H.; Kummel, A.; **Fullerton Shirey, S.K.**; Seabaugh, A.C. “2D Crystal Tunnel Field Effect Transistors” *TECHCON 2016*, September 2016, Austin, TX, USA.

17. Seabaugh, A.;\* Fathipour, S.; Li, H.; Paletti, P.; Kinder, E.; Liu L.; Lu H.; Asghari, M.; Gonzalez, K.; Pandey, P.; Alessandri C.; Remskar, M.; **Fullerton-Shirey, S. K.** “Electric-double-layer field-effect transistors using polyethylene-oxide cesium perchlorate on two-dimensional materials” *Flatlands Beyond Graphene 2016*, July 2016, Bled, Slovenia; Invited.

16. Fathipour, S.;\* Paletti, P.; **Fullerton-Shirey, S.**; Seabaugh, A. “Demonstration of electric double layer p-i-n junction in WSe<sub>2</sub>” *74<sup>th</sup> Device Research Conference*, June 2016, University of Delaware, Newark, DE, USA.

15. Li, M.O.;\* Xiao, S.; Yan, R.; Vishwanath, S.; **Fullerton-Shirey, S.**; Jena, D.; Xing, H.G. “Fermi Level Tunability of A Novel 2D Crystal: Tin Diselenide (SnSe<sub>2</sub>)” *74<sup>th</sup> Device Research Conference*, University of Delaware, June 2016, Newark, DE, USA.

14. Kummel, A.;\* Park, J.H.; Kwak, I.; Chagarov, E.; Movva, H.; Chou, H.; Banerjee, S.K.; Fathipour, S.; Seabaugh, A.; **Fullerton, S.**; Vishwanath, S.; Xing, H.G.; Choudhury, P. “Phthalocyanine Monolayer Nucleation of Gate Oxide ALD on Single Layer Graphene and TMD Surfaces” *Electrochemical Society Spring Meeting*, June 2016, San Diego, CA, USA, Invited.

13. Fathipour, S.;\* Li, H.-M.; Remskar, M.; Yeh, L.; Tsai, W.; Chen, E.; Lin, Y.; **Fullerton-Shirey, S.**; Seabaugh, A. "Record high current density and low contact resistance in MoS<sub>2</sub> FETs by ion doping" *2016 Very Large Scale Integration-Technology, Systems and Applications (VLSI-TSA)* April 2016, Hsinchu, Taiwan, .
12. Kwak, I.;\* Park, J.H.; Lu, H.; Sardashti, K.; Ahles, C.F.; Vishwanath, S.; Xing, H.G.; Seabaugh, A.; **Fullerton, S.**; Kummel, A.C. "Functionalization of TMDs for Deposition of ALD NanoScale Dielectrics for FETs with Low SubThreshold Swing" *MRS Spring Meeting*, March 2016, Phoenix, AZ, USA, Poster.
11. Park, J.H.; Kwak\*, I.; Chagarov, E.; Sardashti, K.; Movva, H.C.P.; Chou, H.; Banerjee, S.K.; Fathipour, S.; **Fullerton-Shirey, S.K.**; Seabaugh, A.; Vishwanath, S.; Xing, H.G.; Choudhury, P.; Kummel, A.C. "Monolayer Organic Films for Nucleation of ALD on Single Layer Graphene and TMD surfaces" *46<sup>th</sup> IEEE Semiconductor Interface Specialists Conference (SISC)* December 2-5th, 2015, Arlington, VA, USA.
10. Seabaugh, A.\*; Appenzeller, J.; Asbeck, P.; Chen, Z.; Cho, K.J.; Datta, S.; Feenstra, R.; Fay, P. **Fullerton, S.K.**, Hock, A., Hu, S., Javey, A., Jenna, D., Keller, S., Kim, M., Klimeck, G., Kummel, A., Mayer, T., Narayanan, V., Niemier, M., Robinson, J., Salahuddin, S., Stemmer, S., Van de Walle, C., Vogel, E., Wallace, R., Xing, H. G. "STARnet Center for Low Energy Systems Technology" *11th International Nanotechnology Conference on Communication and Cooperation*, May 2015, Fukouka-city, Fukouka, Japan. Poster.
9. Park J.H.\*; Kwak, I.; Choudhury, P.; Sardashti, K.; Prakash, H.C.; Banerjee, S.; **Fullerton, S.**; Kummel, A.C. "Self Assembled Ordered Phthalocyanine Monolayers on 2D Semiconductors for Subnanometer Dielectrics ALD Nucleation" *Spring MRS meeting*, April 2015, San Francisco, CA. Invited.
8. Fathipour, S.;\* Xu, H.; Kinder, E.; **Fullerton-Shirey, S.**; Seabaugh A. "Investigation of aging and restoration of polyethylene-oxide cesium- perchlorate solid polymer electrolyte used for ion doping of a WSe<sub>2</sub> field-effect transistor" *72nd Device Research Conference*, June 2014, Santa Barbara, CA, USA. Poster.
7. Khan, A.A.\*; Ahmed, T.; Vigil, G.D.; **Fullerton-Shirey, S.K.**; Howard, S.S. "Photophysical properties of novel Ru-complex probes for two-photon dissolved oxygen imaging" *CLEO: 2014*, June 2014, San Jose, CA, USA.
6. Hwang, W.S.\*; Fathipour, S.; Seabaugh, A.; Xing, H.; **Fullerton-Shirey, S.K.**; Jena, D. "Two-Dimensional Crystal Semiconductors for Beyond Si Technology" *2014 Collaborative Conference on Materials Research (CCMR)*, June 23-27, 2014, Incheon/Seoul, South Korea. *Invited*.
5. Seabaugh, A.\*; Lu, H.; Ma, N.; Fathipour, S.; Kinder, E.; Sabnis, S.; Xu, H.; Asghari Heidarlou, M.; Hwang, W.S.; **Fullerton-Shirey, S.**; Jena, D. "Materials Challenges for Steep Subthreshold-Swing Transistors" *2014 Collaborative Conference on Materials Research (CCMR)*, June 23-27, 2014, Incheon/Seoul, South Korea. *Invited*.
4. Kwak, I.\*; Park J.H.; Movva, H.C.P., Kinder, E.; Lu, H.; Akinwande, D.; Seabaugh, A.; **Fullerton, S.**; Banerjee, S.; Kummel A.; "Graphene Transfer Using Sacrificial PIB Layer onto 1nm Al<sub>2</sub>O<sub>3</sub>/TiOPc/Graphene Gate Stacks" *Spring MRS meeting*, April 21-25, 2014, San Francisco, CA. Poster.
3. Wang, W.\*; Gong, C.; **Fullerton, S.**; Seabaugh, A. "First Principles Study on Crown Ether and Crown Ether-Li Complex Interactions with Graphene" *Spring MRS meeting*, April 21-25, 2014, San Francisco, CA.
2. Lu, H.\*; Kinder, E.; Vahala, J.; Hwang, W.S.; Gong, C.; Cho, K.; Hong, S.K.; Cho, B.J.; **Fullerton-Shirey, S.**; Seabaugh, A. "Low-Voltage Nonvolatile Graphene Memory Based on Ion Transport" *INC*



9, May 2013, Berlin, Germany, Poster.

1. Khan, A.A.\*; DeLeon, E.R.; Ahmed, T.; **Fullerton-Shirey, S.K.**; Olson, K.R.; Howard, S.S. “Chemical Probes for Two-Photon Bioimaging Based on Surfactant Nanomicelles and Ormosil PEB-BLEs” *CLEO: 2013*, June 2013, San Jose, CA, USA. Poster.