

Andrew S. Westover

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Professional Experience:

- **R&D Associate**, Chemical Sciences Division, Oak Ridge National Laboratory
2018-Present
- **Postdoctoral R&D Associate**, Chemical Sciences Division, Oak Ridge National
2017-2018

Education: **Ph.D. in Interdisciplinary Material Science and Engineering**

Vanderbilt University, (3.91/4.00 GPA), Dec 2016

Dissertation: “Challenging Conventional Approaches to Energy Storage: Direct Integration of Energy Storage into Solar Cells, the Use of Scrap Metals to Build Batteries, and the Development of Multifunctional Structural Energy Storage Composites.”

B.S. in Physics and Japanese

Brigham Young University, (3.84/4.00 GPA), Aug 2012

Senior Thesis: “Evolution of Magnetic Domain Morphology in Co/Pt Thin Films.”

Awarded Funding (lead PI, Co-PI):

- *Precision Control of the Li Surface for Solid State Batteries* – DOE EERE VTO
2021 Lab Call – \$3.25 M across 5 years - PI
- *Solid Electrolytes Research and Development* – Strategic Partnership - \$1.5 M
2022-2023– Co-PI
- *High Energy Density Solid State Batteries* – ORNL Laboratory Directed Research
and Development (LDRD) 2020 - \$900k for 1 year - PI

Professional Service:

- DOE – EERE – Vehicle Technology Office – Task lead for Battery Material
Research Program
- Organized a workshop for the DOE-AMO Energy Storage Grand Challenge on
the Manufacturing of Solid-State Batteries – May 13, 2022
- Symposium organizer MRS Fall meeting 2020: “*Overcoming the Challenges with
Metal Anodes for High-Energy Batteries*”
- Reviewer: DOE EERE VTO, FOA/SBIR–2020, 2021, 2022, Joule, Nature
Communications, Journal of Materials Chemistry A, ACS Applied Energy
Materials, Advanced Energy Materials, Advanced Functional Materials, Energy
Storage Materials, Journal of the Electrochemical Society
- Electrochemical Society (ECS) – Member
- Materials Research Society (MRS) – Member
- American Chemical Society (ACS) – Member

Safety Record:

- Lab Safety Manager – August 2021 – present. Lab hazards include vacuum systems, pressure vessels, acids, bases, organics, pyrophoric materials (Li metal), cryogenics.
- Developed safety protocols for a large-scale Li evaporator including cleaning and waste disposal.

Mentoring Experience:

- Early Career Research Professional, Oak Ridge National Laboratory – Spring 2020 - Present
- Early Career Technical Professional, Oak Ridge National Laboratory – Summer 2020 - Present
- Post Bachelors – Fall 2018 - Spring 2020
- SULI students – Summer 2018, Summer 2019, Spring 2022

Publications (by topic area)

Solid State Batteries:

- 1) **Andrew S. Westover**,* Alec S. Ho,* , Katie Browning, Jacqueline A. Maslyn, Dilworth Y. Parkinson, Ritu Sahore, Nancy Dudney, Nitash P. Balsara, “Comparing the Purity of Rolled versus Evaporated Lithium Metal Films Using X-ray Microtomography”, *ACS Energy Letters*, 7 (3), 1120-1124. Feb 2022.
- 2) Ritu Sahore, Guang Yang, Xi Chelsea Chen, Wan-Yu Tsai, Jianlin Li, Nancy J Dudney, **Andrew Westover**, “A Bilayer Electrolyte Design to Enable High-Areal-Capacity Composite Cathodes in Polymer Electrolytes Based Solid-State Lithium Metal Batteries”, *ACS Applied Energy Materials*, 5 (2), 1409-1413. Feb. 2022
- 3) W Blake Hawley, Zhijia Du, Alexander J Kukay, Nancy J Dudney, **Andrew S Westover**, Jianlin Li, “Deconvoluting sources of failure in lithium metal batteries containing NMC and PEO-based electrolytes”, *Electrochimica Acta*, 404, 139579, Jan 2022.
- 4) Sergiy Kalnaus, Ruhul Amin, Chad Parish, Anand Parejiya, Rachid Essehli, **Andrew Westover**, Wan-Yu Tsai, Jagjit Nanda, Ilias Belharouak, “Effect of Composition on Mechanical Properties and Conductivity of the Dual-Ion Conductor $\text{Na}_{1+x}\text{Mn}_{x/2}\text{Zr}_{2-x/2}(\text{PO}_4)_3$ for Solid-State Batteries”, *ACS Applied Energy Materials*, 4, 10, 11684-11692, Oct. 2021
- 5) Ritu Sahore, Zhijia Du, Xi Chelsea Chen, W Blake Hawley, **Andrew S Westover**, Nancy J Dudney, “Practical considerations for testing polymer electrolytes for high-energy solid-state batteries”, *ACS Energy Letters*, 6, 6, 2240-2247.
- 6) Jiadeng Zhu, Zhen Zhang, Sheng Zhao, **Andrew S Westover**, Ilias Belharouak, Peng-Fei Cao, “Single-Ion Conducting Polymer Electrolytes for Solid-State Lithium–Metal Batteries: Design, Performance, and Challenges”, *Advanced Energy Materials*, 11, 14,

2003836, Apr. 2021

- 7) Paul Albertus, Venkataramani Anandan, Chunmei Ban, Nitash Balsara, Ilias Belharouak, Josh Buettner-Garrett, Zonghai Chen, Claus Daniel, Marca Doeff, Nancy J Dudney, Bruce Dunn, Stephen J Harris, Subramanya Herle, Eric Herbert, Sergiy Kalnaus, Joesph A Libera, Dongping Lu, Steve Martin, Bryan D McCloskey, Matthew T McDowell, Y Shirley Meng, Jagjit Nanda, Jeff Sakamoto, Ethan C Self, Sanja Tepavcevic, Eric Wachsman, Chunsheng Wang, **Andrew S Westover**, Jie Xiao, Thomas Yersak, “Challenges for and pathways toward Li-metal-based all-solid-state batteries”, *ACS Energy Letters*, 6, 4, 1399-1404, Mar. 2021.
- 8) Sergiy Kalnaus, **Andrew S Westover**, Mordechai Kornbluth, Erik Herbert, Nancy J Dudney, “Resistance to fracture in the glassy solid electrolyte Lipon”, *Journal of Materials Research*, 36, 4, 787-796, Feb. 2021.
- 9) **Andrew S Westover**, Robert L Sacci, Nancy Dudney, “Electroanalytical measurement of interphase formation at a Li metal–solid electrolyte interface”, *ACS Energy Letters*, 5, 12, 3860-3867, Nov. 2020.
- 10) Max J Palmer, Sergiy Kalnaus, Marm B Dixit, **Andrew S Westover**, Kelsey B Hatzell, Nancy J Dudney, X Chelsea Chen, “A three-dimensional interconnected polymer/ceramic composite as a thin film solid electrolyte” *Energy Storage Material*, 26, 242-249, Apr. 2020.
- 11) Kelsey B Hatzell, Xi Chelsea Chen, Corie L Cobb, Neil P Dasgupta, Marm B Dixit, Lauren E Marbella, Matthew T McDowell, Partha P Mukherjee, Ankit Verma, Venkatasubramanian Viswanathan, **Andrew S Westover**, Wolfgang G Zeier, “Challenges in lithium metal anodes for solid-state batteries”, *ACS Energy Letters*, 5, 3, 922-934, Feb. 2020
- 12) **Andrew S Westover**, Andrew K Kercher, Mordechai Kornbluth, Michael Naguib, Max J Palmer, David A Cullen, Nancy J Dudney, “Plasma synthesis of spherical crystalline and amorphous electrolyte nanopowders for solid-state batteries”, *ACS Applied Materials & Interfaces*, 12, 10, 11570-11578, Feb. 2020.
- 13) Nathan D Phillip, **Andrew S Westover**, Claus Daniel, Gabriel M Veith, “Structural degradation of high voltage lithium nickel manganese cobalt oxide (NMC) cathodes in solid-state batteries and implications for next generation energy storage”, *ACS Applied Energy Materials*, 3, 2, 1768-1774, Jan. 2020.
- 14) **Andrew S Westover**, Nancy J Dudney, Robert L Sacci, Sergiy Kalnaus, “Deposition and Confinement of Li Metal along an Artificial Lipon–Lipon Interface”, *ACS Energy Letters*, 4, 651-655, Feb. 2019.
- 15) Nathan D Phillip, Rose E Ruther, Xiahan Sang, Yongqiang Wang, Raymond R Unocic, **Andrew S Westover**, Claus Daniel, Gabriel M Veith, “Synthesis of Ni-rich Thin Film Cathode as Model System for Lithium Ion Batteries”, *ACS Appl. Energy Mater.*, 22, 1405-1412, Jan. 2019.

- 16) Fudong Han, **Andrew S Westover**, Jie Yue, Xiulin Fan, Fei Wang, Miaofang Chi, Donovan N Leonard, Nancy J Dudney, Howard Wang, Chunsheng Wang, “High electronic conductivity as the origin of lithium dendrite formation within solid electrolytes”, *Nature Energy*, 1, Jan. 2019.
- 17) **Andrew S Westover*** Valentina Lacivita,* Andrew Kercher, Nathan D Phillip, Guang Yang, Gabriel Veith, Gerbrand Ceder, Nancy J Dudney, “Resolving the amorphous structure of lithium phosphorus oxynitride (Lipon)”, *Journal of the American Chemical Society* 140 (35), 11029-11038, July 2018.
- 18) **Andrew S. Westover**, Farhan N. Shabab, John W. Tian, Shiva Bernath, Landon Oakes, William R. Erwin, Rachel Carter, Rizia Bardhan, and Cary L. Pint, “Stretching ion conducting polymer electrolytes: In-situ correlation of mechanical, ionic transport, and optical properties”, *Journal of The Electrochemical Society*, 161, E112-E117, Apr. 2014.

Structural Energy Storage:

- 19) Sergiy Kalnaus, Leif E Asp, Jianlin Li, Gabriel M Veith, Jagjit Nanda, Claus Daniel, Xi Chelsea Chen, **Andrew Westover**, Nancy J Dudney, “Multifunctional approaches for safe structural batteries”, *Journal of Energy Storage*, 40, 102747, Aug. 2021.
- 20) **Andrew S Westover***, Nitin Muralidharan,* Eti Teblum,* Deanna Schauben, Anat Itzhak, Merav Muallem, Gilbert D Nessim, Cary L Pint, “Carbon Nanotube Reinforced Structural Composite Supercapacitor”, *Scientific reports* 8 (1), 17662, Dec. 2018.
- 21) **Andrew S. Westover***, Nitin Muralidharan,* Haotian Sun, Nicholas Galioto, Rachel E. Carter, Adam P. Cohn, Landon Oakes and Cary L. Pint, “From the Junkyard to the Power Grid: Ambient Processing of Scrap Metals into Nanostructured Electrodes for Ultrafast Rechargeable Batteries”, *ACS Energy Letters* 1 (5), 1034–1041, Oct. 2016 (Highlighted by Forbes). * Denotes co-first authorship
- 22) **Andrew S. Westover**, Bradly Baer, Babatunde H. Bello, Haotian Sun, Landon Oakes, Leon M Bellan, Cary L Pint, “Multifunctional high strength and high energy epoxy composite structural supercapacitors with wet-dry operational stability”, *Journal of Materials Chemistry A*, 3 (40), 20097-20102, Sep. 2015.
- 23) **Andrew S. Westover**, John W. Tian, Shivaprem Bernath, Landon Oakes, Rob Edwards, Farhan N Shabab, Shahana Chatterjee, Amrutur V Anilkumar, Cary L Pint,, “A multifunctional load-bearing solid-state supercapacitor”, *Nano Letters*, 14 (6), 3197–3202, May 2014. (Highlighted by NSF)

General Energy Storage:

- 24) Mengya Li, **Andrew S. Westover**, Rachel Carter, Landon Oakes, Nitin Muralidharan, Timothy C. Boire, Hak-Joon Sung, Cary L. Pint, “Noncovalent Pi–Pi Stacking at the

Carbon–Electrolyte Interface: Controlling the Voltage Window of Electrochemical Supercapacitors”, *ACS Applied Materials & Interfaces* 8 (30), 19558-19566, July 2016.

- 25) Keith Share, **Andrew Westover**, Mengya Li, Cary L. Pint, “Surface engineering of nanomaterials for improved energy storage—A review”, *Chemical Engineering Science*, May 2016.
- 26) Thomas Metke*, **Andrew S. Westover***, Rachel Carter, Landon Oakes, Anna Douglas, Cary L. Pint, “Particulate-free porous silicon networks for efficient capacitive deionization water desalination”, *Scientific Reports* 6, 24680, Apr. 2016.*
- 27) Adam P Cohn, William R Erwin, Keith Share, Landon Oakes, **Andrew S. Westover**, Rachel E Carter, Rizia Bardhan, Cary L Pint, “All Silicon Electrode Photocapacitor for Integrated Energy Storage and Conversion”, *Nano letters* 15 (4), 2727-2731, Mar. 2015.
- 28) **Andrew S. Westover**, Keith Share, Rachel Carter, Adam P Cohn, Landon Oakes, Cary L. Pint, “Direct integration of a supercapacitor into the backside of a silicon photovoltaic device”, *Applied Phys. Lett.* 104, 213905, May 2014
- 29) Adam P. Cohn, Landon Oakes, Rachel Carter, Shahana Chatterjee, **Andrew S. Westover**, Keith Share, Cary L. Pint, “Assessing the improved performance of freestanding, flexible graphene and carbon nanotube hybrid foams for lithium ion battery anodes”, *Nanoscale*, 6, 4669-4675, Mar. 2014.
- 30) **Andrew S. Westover**, Daniel Freudiger, Zarif S. Gani, Keith Share, Landon Oakes, Rachel E. Carter, Cary L. Pint, “On-Chip High Power Porous Silicon Lithium Ion Batteries with Stable Capacity over 10000 Cycles”, *Nanoscale* 7 (1), 98-103, Nov. 2014.
- 31) Landon Oakes, **Andrew Westover**, Jeremy W Mares, Shahana Chatterjee, William R. Erwin, Rizia Bardhan, Sharon M. Weiss, Cary L. Pint, "Surface engineered porous silicon for stable, high performance electrochemical supercapacitors", *Scientific Reports* 3 ,3020, Oct. 2013. (Highlighted by BBC News)

Carbon Nanomaterials:

- 32) Efrat Shawat Avraham, **Andrew S Westover**, O Girshevitz, Cary L Pint, Gilbert D Nessim, “Modulating the height of carbon nanotube forests by controlling the molybdenum thin film reservoir thickness”, *Nanoscale* 11 (4), 1929-1936, 2019.
- 33) Efrat Shawat Avraham, **Andrew S. Westover**, Anat Itzhak, Lior Shani, Vladislav Mor, Olga Girshevitz, Cary L Pint, Gilbert Daniel Nessim, “Patterned growth of carbon nanotube forests using Cu and Cu/Ag thin film reservoirs as growth inhibitors, *Carbon* 130, 273-280, Apr. 2017
- 34) **Andrew S. Westover**, Junho Choi, Kehang Cui, Takumi Ishikawa, Taiki Inoue, Rong Xiang, Shohei Chiashi, Takahisa Kato, Shigeo Maruyama, and Cary L. Pint, “Load

Dependent Frictional Response of Vertically Aligned Single-Walled Carbon Nanotube Films", *Scripta Materialia* 125, 63-67, Aug. 2016.

- 35) Landon Oakes, Adam P Cohn, **Andrew S. Westover**, Cary L Pint, "Electrophoretic stabilization of freestanding pristine graphene foams with carbon nanotubes for enhanced optical and electrical response", *Materials Letters* 159, 261-264, Nov. 2015.
- 36) Efrat Shawat, Ilana Perelshtein, **Andrew Westover**, Cary L. Pint, Gilbert D. Nessim, "One-step, delamination-enabled high-yield synthesis of self-assembled conductive mats of carbon nanofibers", *Journal of Materials Chemistry A*, 2, 15118-15123, July 2014.
- 37) Landon Oakes, **Andrew Westover**, Masoud Mahjouri-Samani, Shahana Chatterjee, Alexander A. Puretzky, Christopher Rouleau, David B. Geohegan, Cary L. Pint, "Uniform, homogenous coatings of carbonnanohorns on arbitrary substrates from common solvents", *ACS Applied Materials and Interfaces*, 4, 13153, Dec. 2013.

Magnetic Materials:

- 38) Aaron Gentillon, Carson Richards, Luis A Ortiz-Flores, Jeremy Metzner, David Montealegre, Matthew Healey, Kelsey Cardon, **Andrew Westover**, Olav Hellwig, Karine Chesnel, "Robustness of the remanent magnetic domain pattern formation and associated stripe-bubble transitions in Co/Pt multilayers against field sequencing", *AIP Advances*, 11, 1, 015339.
- 39) Karine Chesnel, **Andrew S Westover**, Carson Richards, Brittni Newbold, Matthew Healey, Lauren Hindman, Berg Dodson, Kelsey Cardon, David Montealegre, Jeremy Metzner, Tobias Schneider, Benny Böhm, Fabian Samad, Lorenzo Fallarino, Olav Hellwig, "Morphological stripe-bubble transition in remanent magnetic domain patterns of Co/Pt multilayer films and its dependence on Co thickness", *Physical Review B* 98 (22), 224404, Dec. 2018.
- 40) **Andrew S. Westover**, Karine Chesnel, Kelsey Hatch, Philip Salter, Olav Hellwig, "Enhancement of magnetic domain topologies in Co/Pt thin films by fine tuning the magnetic field path throughout the hysteresis loop", *Journal of Magnetism and Magnetic Materials*, 399, 164-169, Feb. 2016.
- 41) Y.P. Cai, K. Chesnel, M. Trevino, **A. Westover**, R. G. Harrison, J. M. Hancock, S. Turley, A. Scherz, A. Reid, B. Wu, C. Graves, T. Wang, T. Liu, H. Dürr, and J. Stöhr, "Orbital and Spin moments of 5 to 10 nm Fe₃O₄ nanoparticles measured via XMCD", *Journal of Applied Physics*, 115, 17B537, Apr. 2014.

Patents:

- Method of manufacturing a thin film composite solid electrolyte; Xi Chen, Nancy J Dudney, Sergiy Kalnaus, Max J Palmer, Andrew S Westover – US Patent App. 17/497,023, 2022

- Ionically conductive powders and films, and methods of preparation; AK Kercher, **AS Westover**, MN Abdelmalak, NJ Dudney - US Patent App. 16/944,293, 2021

Invited Presentations:

1. “The Mechanical Paradigm for Solid State Batteries: Rigid Li Metal and Ductile Ceramics”, *ACS Western Regional Meeting*, Las Vegas, USA, (October 20-22, 2022)
2. “How Does One Enable High Energy Li Metal Batteries a Case Study with Lipon”, *ECS Fall Meeting*, Atlanta, USA, (October 9-13, 2022)
3. “In pursuit of Li metal batteries: Interfaces, Mechanics, and the Importance of Scale”, *Renaeslar Polytechnic Institute*, Troy, NY (April 28, 2021).
4. “Understanding the structure of amorphous solid state electrolytes using neutron scattering” *Forschungszentrum Juelich GmbH*, Juelich, Germany, (February 2021)
5. “The development of multifunctional structural energy storage composites”, *Bar Ilan University*, Ramat Gan, Israel, (July 12, 2016).
6. “Multifunctional energy storage systems”, *Waseda University*, Tokyo, Japan, (August 8, 2015).

Conference Presentations:

Andrew Westover, “The Structure of the Amorphous Solid Electrolytes LiPON and LiSiPON”, MRS Fall Meeting, Virtual, (Nov. 2020)

Andrew S Westover, Robert Sacci and Nancy J. Dudney, “Electroanalytical Characterization of the Interphase between the Solid Electrolyte Lipon and Li Metal”, ECS Fall Meeting, Virtual, (Oct. 2020)

Andrew Westover, Nancy Dudney, “Can glassy electrolytes enable all-solid-state Li metal batteries?”, Beyond Li Ion XII, Golden, CO, USA, (June 2019)

Andrew Westover, “Resolving the amorphous structure of lithium phosphorus oxynitride (Lipon)”, MRS Fall Meeting, Boston, MA, USA, (November 2018)

Nancy Dudney, **Andrew Westover**, Robert Schmidt, Robert Sacci, and Ashfia Huq, “Dendritic growth of Li metal through solid-state electrolytes: Critical challenges, potential solutions”, ACS Spring Meeting, New Orleans, LA, USA, (March 2018)

Andrew Westover, Andrew Kercher, Michael Naguib, Gabriel Veith, Nancy Dudney, “Why is Lipon electrochemically stable when cycled vs. Li metal?”, MRS Fall Meeting, Boston, MA, USA, (November 27 – December 1, 2017)

Andrew S. Westover, Nitin Muralidharan, Haotian Sun, Nicholas Galioto, Rachel E. Carter, Adam P. Cohn, Landon Oakes, Cary L. Pint, “From the Junkyard to the Power Grid: Ambient Processing of Scrap Metals into Nanostructured Electrodes for Ultrafast Rechargeable Batteries”, ECS Spring Meeting (May 28 – June 1, 2017)

Andrew S. Westover, Eti Teblum, Deanna Schauben, Anat Yitzhak, Nitin Muralidharan, Merav Muallem, Gilbert Nessim, Cary L. Pint, “Carbon Nanotube Reinforced Structural Composite Supercapacitors”, ECS Spring Meeting (May 28 – June 1, 2017) (Poster) (**Award 1st Place Best Student Poster Award in the NANO division**)

Andrew Westover, Eti Teblum, Deanna Schauben, Anat Yitzhak, Nitin Muralidharan, Merav Muallem, Gilbert Nessim, Cary L. Pint, “Carbon Nanotube Reinforced Multifunctional Energy Storage Composites”, MRS Congress, Darmstadt, Germany (September 27-29, 2016) (Poster).

Andrew S. Westover, Naoki Hayakawa, Rong Xiang, Kehang Cui, Kensuke Tsuchiya, Shigeo Maruyama, Cary Pint, “Measuring the Adhesion Energy of Carbon Nanotube Films to Substrates via Microscratch Testing, TMA Spring Meeting, Nashville, TN, USA (February 14-18, 2016), MRS Congress, Darmstadt, Germany (September 27-29, 2016)

Andrew S. Westover, Bradly Baer, John Tian, Shiva Bernath, Babatunde Bello, Haotian Sun, Robert Edwards, Landon Oakes, Farhan Shabob, Shahana Chatterjee, Amrutur Anilkumar, Leon Bellan, Cary L. Pint, “Multifunctional Load Bearing Structural Energy Storage Systems”, MRS Fall Meeting, Boston, MA, USA (November 29-December 4, 2015).

Andrew S. Westover, Thomas Metke, Jeremiah Afolabi, Keith Share, Rachel E Carter, Adam P Cohn, Landon Oakes, Cary L Pint, “Low-Temperature Chemical Passivation Routes for Integration of Supercapacitors Directly into Silicon Solar Cells”, MRS Fall Meeting, Boston, MA, USA (November 29 - December 4, 2015).

Andrew S. Westover, Thomas Metke, Jeremiah Afolabi, Keith Share, Rachel E Carter, Adam P Cohn, Landon Oakes, Cary L Pint, “Low-Temperature Chemical Passivation Routes for Integration of Supercapacitors Directly into Silicon Solar Cells”, ECS Fall Meeting, Phoenix, AZ, USA (October 11-15, 2015).

Andrew S. Westover, Keith Share, Rachel Carter, Adam P Cohn, Landon Oakes, Cary L. Pint, “Direct integration of a supercapacitor into the backside of a silicon photovoltaic device”, MRS Fall Meeting, Boston, MA, USA (November 30-December 5, 2014) (Poster).

Andrew S. Westover, Keith Share, Rachel Carter, Adam P Cohn, Landon Oakes, Cary L. Pint, “Direct integration of a supercapacitor into the backside of a silicon photovoltaic device”, TNSCORE Research Conference, Nashville, TN, USA (June 2014) (Poster).

Andrew S. Westover, Karine Chesnel, Olav Hellwig “Evolution of Magnetic Domain Morphology in CoPt Thin Films”, APS Four Corners Section Annual Research Meeting,

Phoenix, AZ, USA (October 2011).

Andrew Westover, Nathan Gay, Karine Chesnel, Olav Hellwig, “Thickness Dependency of Ferromagnetic Domains in CoPt Multilayers”, APS Four Corners Section Annual Research Meeting, Boulder, CO, USA (October 2009) (Poster).

Language Skills:

- English (native)
- Japanese (Fluent in listening, speaking, reading, proficient in writing)
 - Japanese Language Proficiency Test (JLPT) - Level 2, Dec. 2011
 - ACTFL Oral Proficiency Interview – Advanced Mid, Apr. 2012
 - Writing Proficiency Test – Advanced Low, Apr. 2012
 - Lived in Japan as a Christian missionary from Jan. 2007-Nov. 2008
 - Performed research at the University of Tokyo in the summer of 2015.
- Chinese (Fluent in listening and speaking, intermediate skill in reading and writing)
 - ACTFL Oral Proficiency Interview – Advanced Low, Dec. 2010
 - Hanyu Shuiping Kaoshi (HSK) Level 4 – 274/300, Mar. 2016
 - Study abroad to Nanjing, China in the fall of 2010.

Honors and Awards:

- ORNL Weinberg Fellowship Candidate, 2016
- USA-Israel BSF Prof. Rahomimoff Travel Grant, 2016
- NSF EAPSI Fellow, 2015
- NSF Graduate Research Fellowship Honorable Mention, 2014
- Award Nominee at MRS Poster Presentation, 2014
- BYU ORCA Grant, 2010
- Scholarship for Academic Excellence, 2009-2012
- Physics Departmental Half-Tuition Scholarship, 2011
- Utah New Century Scholarship, 2009-2010

References:

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