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## Research Vision

My research pertains to solid-state and materials chemistry; my interest lies in discovering and understanding emergent properties and reactivity of materials to achieve a paradigm of materials design. As materials are key enablers of technology, the goal of this research is to discover and design new functionality in materials, *i.e.*, control macroscopic electronic and magnetic properties through the competition of local interactions in materials. While we primarily perform experiments to make materials, characterize their structure and properties, we gain additional insight through numerical calculations and simulations.

## Employment

**2013–present** Assistant Professor; Colorado State University, Fort Collins, CO USA  
Department of Chemistry

**2011–2013** Post-doctoral Associate; Johns Hopkins University, Baltimore, MD USA  
Departments of Chemistry, Physics & Astronomy, and the [Institute for Quantum Matter](#), with [Professor Tyrel M. McQueen](#): *Development of low-temperature routes to inorganic materials and structure/property relationships in strongly correlated electron materials and superconductors.*

## Education

**2006–2011** University of California Santa Barbara, Santa Barbara, CA USA  
Ph.D., Biomolecular Science & Engineering; Thesis title: *Kinetic Control of Aqueous Hydrolysis: Modulation of Structure/Property Relationships in Inorganic Crystals*. Advisor: [Professor Daniel E. Morse](#)

**2005** University of Cambridge, Cambridge, U.K.  
Undergraduate Research Fellowship, Summer 2005; Research: *Vibrational properties of disordered materials*. Advisor: [Professor Stephen R. Elliot](#)

**2002–2006** Lehigh University, Bethlehem, PA USA  
B.S., Materials Science & Engineering, June 2006. Minor in Spanish. Research: *Chalcogenide glasses and Nanolithography*. Research Advisor: [Professor Himanshu Jain](#).

## Graduate / Undergraduate Awards

National Science Foundation, Graduate Research Fellowship, 2007-2010  
MRS Graduate Student Award, Silver Medalist, 2010  
Barry M. Goldwater Scholar, 2005

## Awards

- Alfred P. Sloan Foundation, Sloan Research Fellowship, 2017-2019.
- Research Corporation for Scientific Advancement, Cottrell Scholar Award, 2017-2020.
- National Science Foundation, Early CAREER Award, 2017-2022.
- Department of Energy Early Career Award, 2016-2021.

## Group / Mentoring

**Graduate Students:** Victoria Combs (2016–current), Jewels Fallon (2016–current), Ethan Emerson (2015–current), Eve Mozur (2015–current), Paul Todd (2015–current), Loryn Killpack (2014–2016, M.S.), Arnold Paecklar (2014–current), Michael Tarne (2014–2017, M.S.), Mary Marisa (2013–current), Andrew Martinolich (2013–current), Annalise Maughan (2013–current), Greg Terho (2013–2014, M.S.).

**Postdoctoral Associates:** Dr. Josh Kurzman (2013–2015), Dr. Kate Ross (2014–2015), Dr. Iain Oswald (2017–current).

**Undergraduate Interns:** Geordan Brickey (2013–2014), Mitchel Bordelon (2013–2016, *NSF Graduate Research Fellow at UCSB*), Juliette Granger (2015–2016), J. James Allen (2014–current), Mohammed Almaker (2016–current), David Boyle (JMU REU 2016), Andrew Candia (2016–current), Erik Rognerud (2016–current), Julia Trowbridge (2016–current), Kyle Peterson (2016–2017), Alex Milder (Haverford REU 2017).

## Publications (updated October 18, 2017)

With DOI links where available. Also listed at: <http://sites.chem.colostate.edu/neilsonlab/research.html>  
Citation tracking at: [Google Scholar](#).

### In Press or Review (manuscripts available upon request)

J. R. Neilson, N. Drichko, A. Llobet, M. Balasubramanian, M. R. Suchomel, T. M. McQueen, Local increase of symmetry on cooling in  $\text{KNi}_2\text{Se}_2$ . [arXiv]

D. Olds, P. F. Peterson, M. K. Crawford, J. R. Neilson, H.-W. Wang, P. S. Whitfield, K. Page., Combinatorial Appraisal of Transition States for in situ Pair Distribution Function Analysis. *Accepted*.

E. M. Mozur, A. E. Maughan, Y. Cheng, A. Huq, N. Jalarvo, L. L. Daemen, and J. R. Neilson, Orientational Glass Formation in Substituted Hybrid Perovskites. *Under revision*.

A. E. Maughan, A. M. Ganose, A. M. Candia, J. T. Granger, D. O. Scanlon, and J. R. Neilson, Anharmonicity and Octahedral Tilting in Defect-Ordered Hybrid Perovskites. *Submitted*.

### Awarded US Patents:




1. J. R. Neilson, T. M. McQueen, *Magnetocaloric materials for cryogenic liquification*. United States Patent, 9,568,223 (Feb 14, 2017). [USPTO]

### Appeared

39. D. Olds, K. Page, A. Paecklar, P. Peterson, J. Liu, G. Rucker, M. Ruiz-Rodriguez, M. Olsen, M. Pawel, S. Overbury, and J. R. Neilson, A high precision gas flow cell for performing in situ neutron studies of local atomic structure in catalytic materials. *Rev. Sci. Inst.* (2017) 88, 034101. [doi]
38. A. J. Martinolich, J. R. Neilson, Towards Reaction-By-Design: Achieving Kinetic Control of Solid State Chemistry with Metathesis. *Chem. Mater.* (2017) 29(2), 479-489. (*Invited perspective*) [doi]
37. M. E. Marisa, S. Zhou, B. C. Melot, G. F. Peaslee, J. R. Neilson, Paracrystalline Disorder from Phosphate Ion Orientation and Substitution in Synthetic Bone Mineral. *Inorg. Chem.* (2016) 55(23), 12290-12298. [doi]
36. A. J. Martinolich, J. A. Kurzman, J. R. Neilson, Circumventing Diffusion in Kinetically-Controlled Solid-State Metathesis Reactions, *J. Am. Chem. Soc.* (2016), 138(34), 11031-11037. [doi]

35. A. E. Maughan, A. M. Ganose, M. M. Bordelon, D. O. Scanlon, and J. R. Neilson, Defect tolerance to intolerance in the vacancy-ordered double perovskite semiconductors  $\text{Cs}_2\text{SnI}_6$  and  $\text{Cs}_2\text{TeI}_6$ . *J. Am. Chem. Soc.* (2016), 138(27), 8453-8464. [doi]
34. A. J. Martinolich, R. J. Higgins, M. P. Shores, J. R. Neilson, Lewis Base Mediated Polymorph Selectivity of Pyrite  $\text{CuSe}_2$  Through Atom Transfer In Solid State Metathesis. *Chem. Mater.* (2016), 26(6), 1854-1860. [doi]
33. J. A. Kurzman, A. J. Martinolich, and J. R. Neilson. Influence of interstitial Mn on local structure and magnetism in  $\text{Mn}_{1+\delta}\text{Sb}$ . *Phys. Rev. B* (2015), 92, 184414. [arXiv],[doi]
32. K. A. Ross, M. M. Bordelon, G. S. Terho, J. R. Neilson, Nanosized helical magnetic domains in strongly frustrated  $\text{Fe}_3\text{PO}_4\text{O}_3$ . *Phys. Rev. B*, (2015), 92, 134419. [arXiv],[doi]
31. J. R. Neilson, T. M. McQueen, Representational Analysis of Extended Disorder in Atomistic Ensembles Derived from Total Scattering Data. *J. Appl. Crystallogr.*, (2015), 48, 1560-1572. [arXiv],[doi]
30. M. Mourigal, S. Wu, M. B. Stone, J. R. Neilson, J. M. Caron, T. M. McQueen, C. L. Broholm, Block magnetic excitations in the orbitally-selective Mott insulator  $\text{BaFe}_2\text{Se}_3$ , *Phys. Rev. Lett.*, (2015), 115, 047401. [arXiv],[doi]
29. J. A. Kurzman, K. E. Dettelbach, A. J. Martinolich, C. P. Berlinguette, J. R. Neilson, Structural Characteristics and Eutaxy in the Photo-Deposited Amorphous Iron Oxide Oxygen Evolution Catalyst. *Chem. Mater.*, (2015), 27(9), 3462-3470. [doi]
28. A. J. Martinolich, J. A. Kurzman, J. R. Neilson, Polymorph Selectivity of Superconducting  $\text{CuSe}_2$  Through Kinetic Control of Solid-State Metathesis. *J. Am. Chem. Soc.*, (2015), 137(11), 3827-3833. [doi]
27. A. E. Maughan, J. A. Kurzman, J. R. Neilson, Hybrid Inorganic-Organic Materials with an Optoelectronically Active Aromatic Cation:  $(\text{C}_7\text{H}_7)_2\text{SnI}_6$  and  $\text{C}_7\text{H}_7\text{PbI}_3$ . *Inorg. Chem.*, (2015), 54(1), 370-378. [doi]
26. J. P. Sheckleton, J. R. Neilson, T. M. McQueen, Electronic tunability of the frustrated triangular-lattice cluster magnet  $\text{LiZn}_{2-x}\text{Mo}_3\text{O}_8$ , *Mater. Horiz.*, (2015), 2, 76-80. [doi]
25. A. J. Martinolich, J. R. Neilson, Pyrite Formation via Kinetic Intermediates Through Low-Temperature Solid-State Metathesis, *J. Am. Chem. Soc.*, (2014), 136(44) 15654-15659. [doi]
24. J. R. Neilson, N. C. George, M. M. Murr, R. Seshadri, D. E. Morse, Mesostructure from hydration gradients in demosponge biosilica, *Chem. Eur. J.*, (2014), 20(17) 4956-4965. [doi]
23. P. Cottingham, D. C. Miller, J. P. Sheckleton, J. R. Neilson, M. Feyngenson, A. Huq, T. M. McQueen, Dynamic charge disproportionation in the 1D chain material  $\text{PdTeI}$ . *J. Mater. Chem. C*, (2014), 2, 3238-3246. [doi]
22. L. Tao, G. Rouse, J. R. Neilson, B. C. Melot, T. M. McQueen, C. Masquelier, Magnetic Structures of  $\text{LiMBO}_3$  ( $M = \text{Mn, Fe, Co}$ ) lithiated transition metal borates, *Inorg. Chem.*, (2013), 52 (20), 11966-11974. [doi]
21. W. A. Phelan, D. C. Wallace, K. E. Arpino, J. R. Neilson, K. J. Livi, C. R. Seabourne, A. J. Scott, T. M. McQueen, Stacking Variants and Superconductivity in the Bi-O-S System. *J. Amer. Chem. Soc.*, (2013), 135 (14) 5372-5374. [doi]



20. J. R. Neilson, A. Llobet, J. Wen, M. R. Suchomel, T. M. McQueen, Charge density wave fluctuations, heavy electrons, and superconductivity in  $\text{KNi}_2\text{S}_2$ , *Phys. Rev. B*, (2013), 87, 045124. [arXiv],[doi]
19. J. R. Neilson, A. Llobet, A. V. Stier, L. Wu, J.-J. Wen, J. Tao, Y. Zhu, Z. B. Tesanovic, N. P. Armitage, T. M. McQueen, Mixed-valence-driven heavy-fermion behavior and superconductivity in  $\text{KNi}_2\text{Se}_2$ , *Phys. Rev. B*, (2012), 86, 054512. [arXiv],[doi] 
18. L. A. Bawazer, M. Izumi, D. Kolodin, J. R. Neilson, B. Schwenzer, D. E. Morse, Evolutionary selection of enzymatically synthesized semiconductors from biomimetic mineralization vesicles, *Proc. Natl. Acad. Sci. U.S.A.* (2012), 109 (26), E1705-E1714. [doi]
17. J. P. Sheckelton, J. R. Neilson, D. G. Soltan, T. M. McQueen, Possible valence bond condensation in the frustrated cluster magnet  $\text{LiZn}_2\text{Mo}_3\text{O}_8$ , *Nat. Mater.* (2012), 11, 493-496. [doi],[arXiv]
16. J. M. Caron, J. R. Neilson, D. C. Miller, K. Arpino, A. Llobet, T. M. McQueen, Orbital Selective Magnetism in the Spin-Ladder Iron Selenides  $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{Se}_3$ , *Phys. Rev. B*, (2012), 85, 180405(R). [arXiv],[doi] 
15. J. R. Neilson, T. M. McQueen, Bonding, ion mobility, and rate-limiting steps in deintercalation reactions with  $\text{ThCr}_2\text{Si}_2$ -type  $\text{KNi}_2\text{Se}_2$ , *J. Am. Chem. Soc.* (2012), 134 (18), 7750-7757. [doi]
14. J. M. Caron, J. R. Neilson, D. C. Miller, A. Llobet, T. M. McQueen, Iron displacements and magnetoelastic coupling in the spin-ladder compound  $\text{BaFe}_2\text{Se}_3$ , *Phys. Rev. B*, (2011), 84, 180409(R). [arXiv],[doi] 
13. J. R. Neilson, J. A. Kurzman, R. Seshadri, D. E. Morse, Ordering double perovskite hydroxides by kinetically controlled aqueous hydrolysis, *Inorg. Chem.*, (2011), 50, 3003-3009. [doi]
12. J. R. Neilson, B. C. Melot, D. P. Shoemaker, J. Kurzman, R. Seshadri, D. E. Morse, Understanding complex magnetic order in disordered cobalt hydroxides through analysis of the local structure, *Phys. Rev. B*, (2011), 80, 094418. [arXiv],[doi]
11. B. Schwenzer, J. R. Neilson, S. M. Jeffries, D. E. Morse,  $\text{Cd}_{1-x}\text{Zn}_x\text{O}$  [ $0.05 \leq x \leq 0.26$ ] synthesized by vapor-diffusion induced co-nucleation from aqueous metal salt solutions, *Dalton Trans.*, (2011), 40 (6), 1295-1301. [doi]
10. H. L. Zhang, J. R. Neilson, D. E. Morse, Vapor-diffusion-controlled sol-gel synthesis of flaky lithium vanadium oxide and its electrochemical behavior, *J. Phys. Chem. C*, (2010), 114 (45), 19550-19555. [doi]
9. K. Niesz, C. Reji, J. R. Neilson, R. C. Vargas, D. E. Morse, Unusual evolution of ceria nanocrystal morphologies promoted by a low-temperature vapor diffusion based process, *Cryst. Growth Des.*, (2010), 10 (10), 4485-4490. [doi]
8. J. R. Neilson, J. A. Kurzman, R. Seshadri, D. E. Morse, Cobalt coordination and clustering in  $\alpha\text{-Co}(\text{OH})_2$  revealed by synchrotron X-ray total scattering, *Chem. Eur. J.* (2010), 16 (33), 9998-10006. [doi]
7. J. R. Neilson, B. Schwenzer, R. Seshadri, D. E. Morse, Kinetic control of intralayer cobalt coordination in layered hydroxides:  $\text{Co}_{1-0.5x}^{\text{oct}}\text{Co}_x^{\text{tet}}(\text{OH})_2(\text{Cl})_x(\text{H}_2\text{O})_n$ , *Inorg. Chem.* (2009), 48 (23), 11017-11023. [doi]
6. B. Schwenzer, J. R. Neilson, K. Sivula, C. Woo, J. M. J. Frechét, D. E. Morse, Nanostructured *p*-type cobalt layered double hydroxide/*n*-type polymer bulk heterojunction yields an inexpensive solar cell, *Thin Solid Films* (2009) 517, 5722-5727. [doi]

5. B. Schwenzer, L. Z. Pop, J. R. Neilson, T. Sbardellati, D. E. Morse, Nanostructured ZnS and CdS Films synthesized using Layered Double Hydroxide Films as Precursor and Template, *Inorg. Chem.* (2009), 48 (4), 1542-1550. [doi]
4. A. Kovalskiy, J. R. Neilson, A. C. Miller, F. C. Miller, M. Vlček, and H. Jain, Comparative study of electron- and photo-induced structural transformations on the surface of  $As_{35}S_{65}$  amorphous thin films, *Thin Solid Films* (2008) 516, 7511-7518. [doi]
3. J. R. Neilson, A. Kovalskiy, M. Vlček, H. Jain, and F. Miller, Fabrication of nano-gratings in arsenic sulphide films, *J. Non-Cryst. Solids* (2007) 353, 1427-1430. [doi]
2. A. Kovalskiy, H. Jain, J. R. Neilson, M. Vlček, C. M. Waits, W. Churaman, M. Dubey, On the mechanism of gray scale patterning of Ag-containing  $As_2S_3$  thin films, *J. Phys. Chem. Solids* (2007) 68, 920-925. [doi]
1. S. N. Taraskin, S. I. Simdyankin, S. R. Elliot, J. R. Neilson, and T. Lo, Universal features of terahertz absorption in disordered materials, *Phys. Rev. Lett.* (2006) 97, 055504. [doi]

### Professional and Honor societies

American Chemical Society, American Physical Society, Materials Research Society, American Crystallographic Association, Neutron Scattering Society of America, *Phi Beta Kappa*, *Tau Beta Pi*.