

CHRISTOPHER J. BARTEL

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Appointments

Assistant Professor , University of Minnesota Chemical Engineering and Materials Science (link)	2022 – present
Postdoctoral Scholar , University of California, Berkeley Materials Science and Engineering (link) Advisor: Prof. Gerbrand Ceder	2019 – 2022
Graduate Research Assistant , University of Colorado Boulder Chemical Engineering (link) Advisors: Prof. Charles Musgrave & Prof. Alan Weimer Thesis: <i>Data-driven descriptors for the thermochemistry of inorganic crystalline solids</i>	2014 – 2018

Education

PhD University of Colorado Boulder, Chemical Engineering	2014 – 2018
BS Auburn University, Chemical Engineering	2010 – 2014

Publications

[Google Scholar](#) | [ORCID:0000-0002-5198-5036](#)

(* denotes corresponding author, + denotes equal contribution)

33. H. Huo, **C. Bartel**, T. He, A. Trewartha, A. Dunn, B. Ouyang, A. Jain, G. Ceder*, Machine-learning rationalization and prediction of solid-state synthesis conditions, *Chemistry of Materials*, **2022**, Accepted
32. N. Szymanski⁺, Y. Zeng⁺, T. Bennett, S. Patil, J. Keum, E. Self, J. Bai, Z. Cai, R. Giovone, B. Ouyang, F. Wang, **C. Bartel**, R. Clement, W. Tong, J. Nanda, G. Ceder*, Understanding the fluorination of disordered rocksalt cathodes through rational exploration of synthesis pathways, *Chemistry of Materials*, **2022**, Accepted
31. **C. Bartel***, Review of computational approaches to predict the thermodynamic stability of inorganic solids, *Journal of Materials Science*, **2022**, 57:10475-10498 (*invited*)
30. R. O'Toole, C. Hill, P. Buur, **C. Bartel**, C. Gump, C. Musgrave, A. Weimer*, Hydrolysis protection and sintering of aluminum nitride powders with yttria nanofilms, *Journal of the American Ceramic Society*, **2022**, 105, 5, 3123-3127
29. B.J. Kwon*, L. Yin, **C. Bartel**, K. Kumar, P. Parajuli, J. Gim, S. Kim, R. Klie, S. Lapidus, B. Key, G. Ceder, J. Cabana*, Intercalation of Ca into a highly defective oxide at room temperature, *Chemistry of Materials*, **2022**, 34, 2, 836-846
28. R. Kingsbury, A. Gupta, **C. Bartel**, J. Munro, S. Dwaraknath, M. Horton, K. Persson*, Performance comparison of r²SCAN and SCAN metaGGA density functionals for solid materials via an automated, high-throughput computational workflow, *Physical Review Materials*, **2022**, 6, 013801
27. Y. Chen, **C. Bartel**, M. Avdeev, Y. Zhang, P. Zhong, G. Zeng, Z. Cai, H. Kim, H. Ji*, G. Ceder*, Solid-state Ca ion diffusion in Ca_{1.5}Ba_{0.5}Si₅O₃N₆, *Chemistry of Materials*, **2022**, 34, 1, 128-139
26. J. Hancock, K. Griffith, Y. Choi, **C. Bartel**, S. Lapidus, J. Vaughey, G. Ceder, K. Poeppelmeier*, Expanding the ambient-pressure phase space of CaFe₂O₄-type sodium post spinel host-guest compounds, *ACS Organic and Inorganic Au*, **2022**, 2, 1, 8-22 (*invited* | *cover*)
25. H. Park*, **C. Bartel**, G. Ceder, P. Zapol*, Layered transition metal oxides as Ca intercalation cathodes: a systematic first-principles evaluation, *Advanced Energy Materials*, **2021**, 11, 48, 2101698
24. B. Ouyang⁺, J. Wang⁺, T. He, **C. Bartel**, H. Huo, Y. Wang, V. Lacivita, H. Kim, G. Ceder*, Synthetic accessibility and stability rules of NASICONs, *Nature Communications*, **2021**, 12, 5752

23. L. Blanc⁺, **C. Bartel**⁺, Ha. Kim, Y. Tian, Hy. Kim, A. Miura, G. Ceder*, L. Nazar*, Toward the development of a high-voltage Mg cathode using a chromium sulfide host, *ACS Materials Letters*, **2021**, 3, 1213-1220
22. L. Yin, B. Kwon, Y. Choi, **C. Bartel**, M. Yang, C. Liao, B. Key, G. Ceder, S. Lapidus*, Operando X-ray diffraction studies of the Mg-ion migration mechanisms in spinel cathodes for rechargeable Mg-ion batteries, *Journal of the American Chemical Society*, **2021**, 143, 28, 10649-10658
21. N. Szymanski, Y. Zeng, H. Huo, **C. Bartel***, H. Kim*, G. Ceder*, Toward autonomous design and synthesis of novel inorganic materials, *Materials Horizons*, **2021**, 8, 2169-2198 (*invited*)
20. N. Szymanski, **C. Bartel**, Y. Zeng, Q. Tu, G. Ceder*, Probabilistic deep learning approach to automate the interpretation of multi-phase diffraction spectra, *Chemistry of Materials*, **2021**, 33, 11, 4204-4215
19. A. Miura⁺*, **C. Bartel**⁺, Y. Goto, Y. Mizuguchi, C. Moriyoshi, Y. Kuroiwa, Y. Wang, T. Yaguchi, M. Shirai, M. Nagao, N. Rosero-Navarro, K. Tadanaga, G. Ceder, W. Sun*, Observing and modeling the sequential pairwise reactions that drive solid-state ceramic synthesis, *Advanced Materials*, **2021**, 33, 24, 2100312
18. J. Koettgen, **C. Bartel**, J. Shen, K. Persson, G. Ceder*, First-principles study of CaB₁₂H₁₂ as a potential solid-state conductor for Ca, *Physical Chemistry Chemical Physics*, **2020**, 22 (47), 27600-27604
17. **C. Bartel***, A. Trewartha, Q. Wang, A. Dunn, A. Jain, G. Ceder*, A critical examination of compound stability predictions from machine-learned formation energies, *npj Computational Materials*, **2020**, 6, 97
16. N. Singstock, **C. Bartel**, A. Holder*, C. Musgrave*, High-throughput analysis of materials for chemical looping processes, *Advanced Energy Materials*, **2020**, 14, 2000685
15. A. Miura*, H. Ito, **C. Bartel**, W. Sun*, N. Rosero Navarro, K. Tadanaga, H. Nakata, K. Maeda, G. Ceder, Selective metathesis synthesis of MgCr₂S₄ by control of thermodynamic driving forces, *Materials Horizons*, **2020**, 7, 1310-1316
14. **C. Bartel***, J. Clary, C. Sutton, D. Vigil-Fowler, B. Goldsmith, A. Holder, C. Musgrave*, Inorganic halide double perovskites with optoelectronic properties modulated by sublattice mixing, *Journal of the American Chemical Society*, **2020**, 142, 11, 5135-5145 (*correction*)
13. J. Koettgen, **C. Bartel**, G. Ceder*, Computational investigation of chalcogenide spinel conductors for all-solid-state Mg batteries, *Chemical Communications*, **2020**, 56, 1952-1955
12. E. Rognerud⁺, C. Rom⁺, P. Todd, N. Singstock, **C. Bartel**, A. Holder, J. Neilson*, Kinetically controlled low-temperature solid-state metathesis of manganese nitride Mn₃N₂, *Chemistry of Materials*, **2019**, 31, 18, 7248-7254
11. W. Sun*, **C. Bartel**, E. Arca, S. Bauers, B. Matthews, B. Orvañanos, J. Tate, W. Tumas, A. Zakutayev, S. Lany, A. Holder*, G. Ceder, A map of the inorganic ternary metal nitrides, *Nature Materials*, **2019**, 18, 732-739
10. **C. Bartel**, J. Rumptz, A. Weimer, A. Holder*, C. Musgrave*, High-throughput equilibrium analysis of active materials for solar thermochemical ammonia synthesis, *ACS Applied Materials & Interfaces*, **2019**, 11, 28, 24850-24858 (*invited*)
9. A. Palumbo, **C. Bartel**, J. Sorli, A. Weimer*, Characterization of products derived from the high temperature flash pyrolysis of microalgae and rice hulls, *Chemical Engineering Science*, **2019**, 196, 527-537
8. **C. Bartel***, C. Sutton, B. Goldsmith, R. Ouyang, C. Musgrave, L. Ghiringhelli*, M. Scheffler, New tolerance factor to predict the stability of perovskite oxides and halides, *Science Advances*, **2019**, 5, eaav0693
7. **C. Bartel**, A. Weimer, S. Lany, C. Musgrave*, A. Holder*, The role of decomposition reactions in assessing first-principles predictions of solid stability, *npj Computational Materials*, **2019**, 5 (1), 4

6. R. O'Toole⁺, **C. Bartel**⁺, M. Kodas, A. Horrell, S. Ricote, N. Sullivan, C. Gump, C. Musgrave, A. Weimer*, Particle atomic layer deposition of alumina for sintering yttria-stabilized cubic zirconia, *Journal of the American Ceramic Society*, **2019**, 102 (5) 2283-2293
5. **C. Bartel**, S. Millican, A. Deml, J. Rumptz, W. Tumas, A. Weimer, S. Lany, V. Stevanović, C. Musgrave*, A. Holder*, Physical descriptor for the Gibbs energy of inorganic crystalline solids and temperature-dependent materials chemistry, *Nature Communications*, **2018**, 9, 4168
4. B. Goldsmith*, J. Esterhuizen, J. Liu, **C. Bartel**, C. Sutton, Machine learning for heterogeneous catalyst design and discovery, *AIChE Journal*, **2018**, 64 (7), 2311-2323 (*invited* | *cover*)
3. E. Arca*, S. Lany, J. Perkins, **C. Bartel**, J. Mangum, W. Sun, A. Holder, G. Ceder, B. Gorman, G. Teeter, W. Tumas, A. Zakutayev*, Redox-mediated stabilization of zinc molybdenum nitride, *Journal of the American Chemical Society*, **2018**, 140 (12), 4293-4301 (*cover*)
2. S. Zhang, E. Yu., S. Gates, W. Cassata, J. Makel, A. Thron, **C. Bartel**, A. Weimer, R. Faller, P. Stroeve, J. Tringe*, Helium interactions with alumina formed by atomic layer deposition show potential for mitigating problems with excess helium in spent nuclear fuel, *Journal of Nuclear Materials*, **2018**, 499, 301-311
1. **C. Bartel**, C. Muhich, A. Weimer*, C. Musgrave*, Aluminum nitride hydrolysis enabled by hydroxyl-mediated surface proton hopping, *ACS Applied Materials & Interfaces*, **2016**, 8 (28), 18550-18559

2 other publications

2. **C. Bartel***, Data-centric approach to improve machine learning models for inorganic materials, *Patterns*, **2021**, 2, 11, 100361 (*invited preview*)
1. **C. Bartel**, A. Weimer, R. O'Toole, M. Kodas, Performance of technical ceramics, **2020**, US Patent App. 16/506,235

1 manuscript under review

1. R. Shernbody⁺, R. Smaha⁺, **C. Bartel**, M. Holtz, K. Talley, B. Levy-Wendt, C. Perkins, S. Eley, A. Zakutayev, G. Brennecke*, High-throughput selection and experimental realization of two new Ce-based nitride perovskites: CeMoN₃ and CeWN₃, *Under review*

Awards

Outstanding Reviewer for <i>Materials Horizons</i>	2020
One of 10 selected for number, timeliness, and quality of reviews (link)	
Max S. Peters Outstanding Graduate Student Award	2019
Awarded annually to the top Ph.D. graduate in Chemical Engineering at CU-Boulder	
DOE EFRC Team Science Competition Winner	2019
One of 6 winners from 40 EFRC teams (link)	
University of Washington Distinguished Young Scholars Seminar	2019
One of 8 selected speakers from >100 applicants (link)	
Department of Education GAANN Fellowship (×2)	2017, 2018
Provided full tuition and graduate stipend for 15 months	
National Science Foundation Graduate Research Fellowship	2014 – 2017
Provided full tuition and graduate stipend for 36 months	
Department of Chemical and Biological Engineering Service Award (×2)	2016, 2017
Awarded for leading the organization of volunteering and outreach events	

Funding

Topological Magnetic Materials for Energy Efficient Spintronics	2022-2023
Source: NSF MRSEC Seed	
Bartel role: co-PI	
Bartel support (<i>total support</i>): \$30,000 (\$150,000)	
other PIs: T. Low (PI), B. Jalan, A. Mkhoyan, J.-P. Wang, X. Wang	

Teaching

Course Instructor

University of Minnesota — Chemical Engineering and Materials Science

CHEN 3005 – Transport Phenomena: Momentum and Heat Fall 2022

CHEN 5802 – Applications of Machine Learning in the Chemical Sciences Spring 2023

Guest Lecturer (e.g.,)

University of California, Berkeley | Materials Science and Engineering

MSE 201A – Thermodynamics and Phase Transformations in Solids Fall 2019, 2020, 2021

Instructor: Prof. Gerbrand Ceder (gceder@berkeley.edu)

[Lectures 17-19 on YouTube](#)

MSE 136 – Materials in Energy Technologies Fall 2019

Instructor: Prof. Kristin Persson (kapersson@lbl.gov)

Graduate Teaching Assistant

University of Colorado Boulder | Chemical Engineering

CHEN 5740 – Analytical Methods for Chemical Engineers Fall 2016

Instructor: Prof. Will Medlin (will.medlin@colorado.edu)

CHEN 3320 – Chemical Engineering Thermodynamics Fall 2014

Instructor: Prof. John Falconer (john.falconer@colorado.edu)

Service

Peer Reviewer

2018 – present

Journals: *EES*, *Adv Mater*, *JACS*, *Nat Commun*, *Mater Horiz*, *ACS Energy Lett*, *Chem Mater*, *ACS Mater Lett*, *JMCA*, *npj Comp Mater*, *Digital Discovery*, *PRX Energy*, *Patterns*, *JPCC*, *PCCP*, *APL*, *APL Mater*, *Catal Sci Tech*, *J Mater Sci*, *J App Phys*, *ACS Omega*, *J Phys Chem Solids*

Agencies: US DOE Office of Science (BES-CMS, BES-CCS, SCGSR)

Co-chair Graduate Leadership Council Service Department

2015 – 2018

Planned and led volunteering and outreach events for Chem. E. graduate department

Tutor & Session Chair: NOMAD Summer School

2018

Hands-on course for novel materials discovery

Student Co-organizer: Intl. Conference for Ternary and Multinary Compounds

2018

College of Engineering and Applied Sciences Graduate Mentorship Program

2017

Developed and participated in workshops to foster positive mentor-mentee relationships

Presentations

20. **AICHE 2022 Annual Meeting** | Phoenix, AZ | November 2022
Fundamental Theory and Characterizations for Optoelectronic Materials
19. **U of Toronto Chemical Engineering & Applied Chemistry** | Toronto, ON | March 22, 2022
Department seminar
18. **UC Irvine Materials Science and Engineering** | Irvine, CA | March 17, 2022
Department seminar
17. **University of Utah Chemical Engineering** | Salt Lake City, UT | March 10, 2022
Department seminar
16. **U of Maryland Chemical & Biomolecular Engineering** | College Park, MD | March 7, 2022
Department seminar
15. **TMS 2022 Annual Meeting** | Anaheim, CA | February 28, 2022
Phase Stability, Transformations, and Reactive Formation in Electronic Materials XXI

14. **U Minnesota Chemical Engineering & Materials Science** | Minneapolis, MN | Feb 22, 2022
Department seminar
13. **OSU Chemical & Biological Engineering** | Columbus, OH (*virtual*) | February 15, 2022
Department seminar
12. **NC State University Chemical & Biomolecular Engineering** | Raleigh, NC | February 9, 2022
Department seminar
11. **University of Utah Chemistry** | Salt Lake City, UT (*virtual*) | January 31, 2022
Department seminar
10. **University of Florida Chemical Engineering** | Gainesville, FL | January 24, 2022
Department seminar
9. **University of Virginia Chemical Engineering** | Charlottesville, VA | January 20, 2022
Department seminar
8. **Indiana University Chemistry** | Bloomington, IN | January 12, 2022
Department seminar
7. **SUNY Buffalo Materials Design and Innovation** | Buffalo, NY | December 17, 2021
Department seminar
6. **Northeastern University Chemical Engineering** | Boston, MA (*virtual*) | February 19, 2021
Department seminar
5. **TMS 2021 Annual Meeting** | Orlando, FL (*virtual*) | March 18, 2021
Phase Stability, Transformations, and Reactive Formation in Electronic Materials X ([link](#))
4. **ASM International IMAT 2020** | Cleveland, OH | September 2020 (canceled due to COVID-19)
Materials 4.0: Materials Information in the Product Life Cycle
3. **Georgia Tech Chemical & Biomolecular Engineering** | Atlanta, GA | January 13, 2020
Department seminar
2. **Lawrence Berkeley National Laboratory** | Berkeley, CA | August 12, 2019
Digital Solar Redox Materials Design Workshop
1. **University of Washington Chemical Engineering** | Seattle, WA | July 1, 2019
Distinguished Young Scholars Seminar Series ([link](#))