Stanford

Kieran Orr

Postdoctoral Scholar, Materials Science and Engineering

Bio

BIO

Following undergraduate studies and postgraduate research in the United Kingdom, using synchrotron radiation to study the crystalline structures of semiconductors for solar energy applications, Kieran's work at Stanford now focusses on using related diffraction techniques on an ultra-fast timescale to study ion hopping in solid electrolytes for all solid-state batteries.

PROFESSIONAL EDUCATION

- PhD, University of Cambridge , Physics (2024)
- MChem, University of Oxford , Chemistry (2019)

STANFORD ADVISORS

- Aaron Lindenberg, Postdoctoral Faculty Sponsor

LINKS

- Google Scholar: https://scholar.google.com/citations?user=rVnyirwAAAAJ&hl=en
- Scopus: https://www.scopus.com/authid/detail.uri?authorId=57265159400
- ORCiD: https://orcid.org/0000-0001-9996-1458

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Kieran’s current research focuses on improving solid-state electrolytes for batteries and fuel cells. Key challenges for these technologies include replacing the harmful and flammable liquid electrolytes currently used as industry standards and achieving fast charging to improve commercial competitiveness, especially in the transportation sector. Substituting current ion transport media with a highly conductive solid-state electrolyte has the potential to address these challenges, drastically improving energy storage and energy conversion devices. However, the precise mechanism of ion hopping in solids is poorly understood, having been studied primarily from theoretical and computational standpoints. Kieran uses a suite of atomic-scale sensitive real-time structural probes making heavy use SLAC’s X-ray diffraction capabilities to gain a detailed, mechanistic understanding of how ions are transported through solid electrolytes.

LAB AFFILIATIONS

- Aaron Lindenberg (7/1/2024)
- William Chueh (7/1/2024)
- David Reis (7/1/2024)

Publications

PUBLICATIONS

- **Strain relaxation in halide perovskites via 2D/3D perovskite heterojunction formation.** *Science advances*
  Liu, D., Bi, J., Xu, W., Orr, K. W., Wang, F., Liu, X., Ren, A., Zhang, J., Hinder, S., Li, B., Luo, X., Shen, Y., Hu, et al
  2025; 11 (26): eadu3459

- **Dynamic nanodomains dictate macroscopic properties in lead halide perovskites.** *Nature nanotechnology*
  Dubajic, M., Neilson, J. R., Klarbring, J., Liang, X., Bird, S. A., Rule, K. C., Auckett, J. E., Selby, T. A., Tumen-Ulzii, G., Lu, Y., Jung, Y. K., Chosy, C., Wei, et al
  2025

- **Strain Heterogeneity and Extended Defects in Halide Perovskite Devices** *ACS ENERGY LETTERS*
  Orr, K. W. P., Diao, J., Dey, K., Hameed, M., Dubajic, M., Gilbert, H. L., Selby, T. A., Zelewski, S. J., Han, Y., Fitzsimmons, M. R., Roose, B., Li, P., Fan, et al
  2024; 9 (6): 3001-3011

- **Composition Dictates Octahedral Tilt and Photostability in Halide Perovskites** *ADVANCED MATERIALS*
  Iqbal, A. N., Orr, K. W. P., Nagane, S., Orri, J., Doherty, T. A. S., Jung, Y., Chiang, Y., Selby, T. A., Lu, Y., Mirabelli, A. J., Baldwin, A., Ooi, Z., Gu, et al
  2024; 36 (28): e2307508

- **Nanoscale chemical heterogeneity dominates the optoelectronic response of alloyed perovskite solar cells** *NATURE NANOTECHNOLOGY*
  Frohna, K., Anaya, M., Macpherson, S., Sung, J., Doherty, T. A. S., Chiang, Y., Winchester, A. J., Orr, K. W. P., Parker, J. E., Quinn, P. D., Dani, K. M., Rao, A., Stranks, et al
  2022; 17 (2): 190-196

- **Single-step synthesis and interface tuning of core-shell metal-organic framework nanoparticles** *CHEMICAL SCIENCE*
  Orr, K. W. P., Collins, S. M., Reynolds, E. M., Nightingale, F., Bostroem, H. L. B., Cassidy, S. J., Dawson, D. M., Ashbrook, S. E., Magdysyuk, O., Midgley, P. A., Goodwin, A. L., Yeung, H.
  2021; 12 (12): 4494-4502