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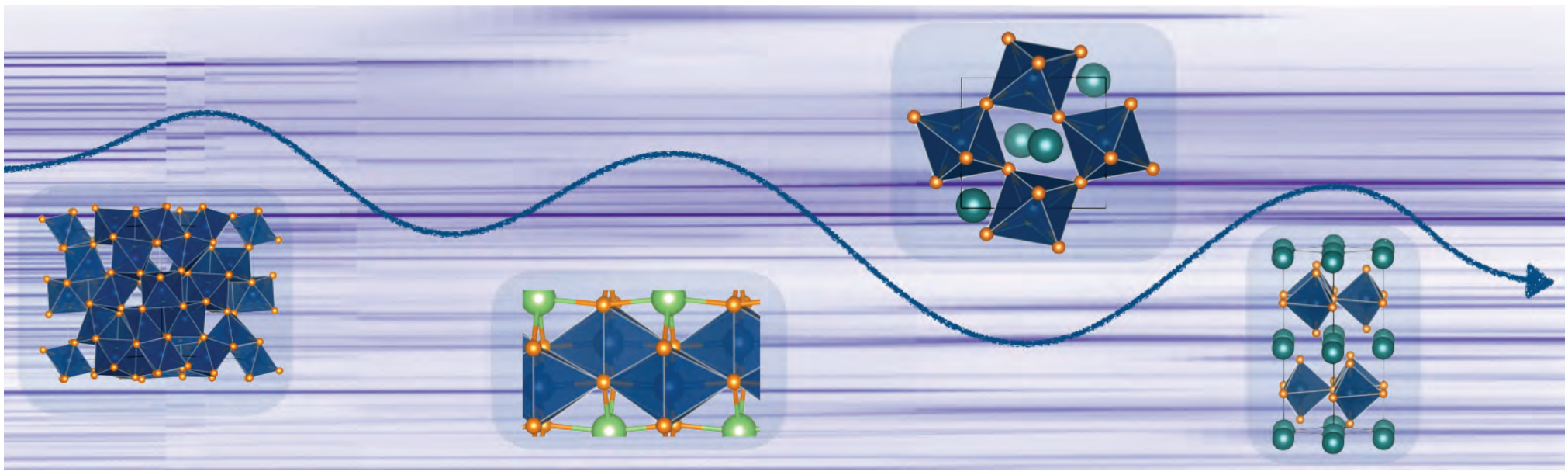
James Neilson

Toward Prescriptive Materials Synthesis: Watching Kinetic Control in Solid State Chemistry with X-rays



The rational control of structure-property relationships to achieve desired properties remains a significant challenge in materials research. Current strategies involve the incremental modification of existing materials or the serendipitous discovery of materials. These approaches are successful only when the desired materials are the most stable phase under synthesis conditions; however, many materials are metastable during synthesis or use. Therefore, we synthesize such metastable materials in the limit of kinetic control, where the reaction pathway is modified to selectively form one phase over another. Synchrotron x-ray diffraction and total scattering experiments have enabled us to watch these solid-state reactions *in situ* and gain insight into how kinetic control is achieved in the formation of a metastable superconductor (high-pressure $CuSe_2$) and yttrium manganese oxides. These results show how modern x-ray science is enabling a paradigm of prescriptive materials synthesis.

James Neilson received his Ph.D. in 2011 from the University of California, Santa Barbara, and performed postdoctoral research at Johns Hopkins University until 2013. In 2013, he joined the faculty of Colorado State University as an Assistant Professor in the Department of Chemistry. Since then, he has received numerous awards for his research and teaching, including the Sloan Research Fellowship from the A. P. Sloan Foundation, the Cottrell Scholar Award from the Research Corporation for Science Advancement, and early career awards from both the Department of Energy and National Science Foundation.

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Bldg. 402 | APS Auditorium
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