Advanced Monolithic 2D Multilayer Laue Lens (MLL) Optics for Hard X-ray Nanofocusing and Nanotomography

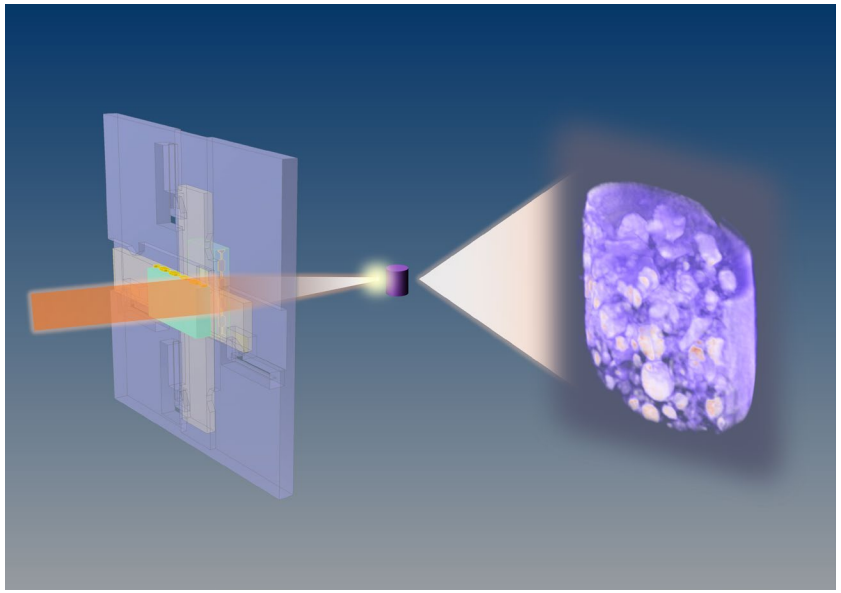

Illustration of monolithic 2D MLL Optics used for 3D tomographic imaging of a $CoFe_2O_4$-$Ce_{0.8}Gd_{0.2}O_2$-based mixed ionic-electronic conductors (MIECs) sample. The reconstructed 3D image provides valuable insight into the heterogeneous nature of the system, revealing clear phase separation and a varied grain-size distribution.

W. Xu, Z. Gao, W.H. Xu, N. Bouet, J. Zhou, H. Yan, X. Huang, M. Lu, M. Ge, Y. S. Chu, E. Nazaretski; "Advanced monolithic 2D multilayer Laue lens (MLL) optics for hard x-ray nanofocusing and nanotomography". *Appl. Phys. Lett.* **128 (15)**, 151101 (2026) (**Cover Image**)
https://doi.org/10.1063/5.0318272

Scientific Achievement

Researchers developed a new generation of monolithic 2D MLL optics for high-resolution hard X-ray nanoimaging, demonstrating sub-10 nm resolution in 2D and ~30 nm in 3D imaging experiments at 15 keV.

Significance and Impact

The new 2D optics exhibit significantly improved alignment accuracy and stability, representing a crucial step forward in advancing 2D MLL technology toward direct imaging with sub-10 nm spatial resolution.

Research Details

- The 2D optics were assembled using a microfabricated silicon template, achieving an orthogonal alignment accuracy of ~0.005°.
- The developed optics were successfully implemented in nanotomographic experiments on a MIECs sample used for applications in energy conversion and catalysis.

Brookhaven National Laboratory | NSLS-II National Synchrotron Light Source II | Center for Functional Nanomaterials, Brookhaven National Laboratory | Advanced Science Research Center, The Graduate Center, City University of New York

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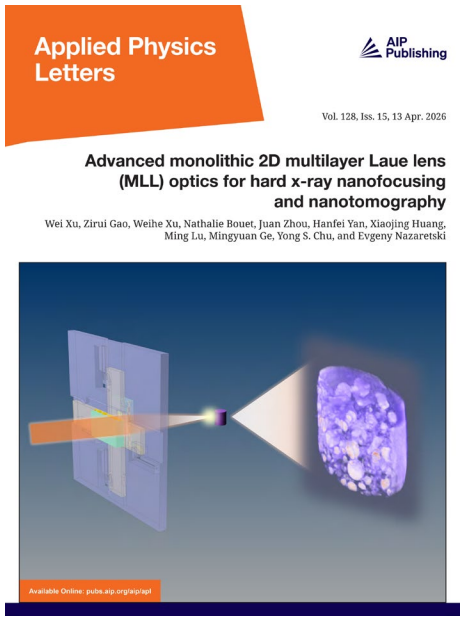

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