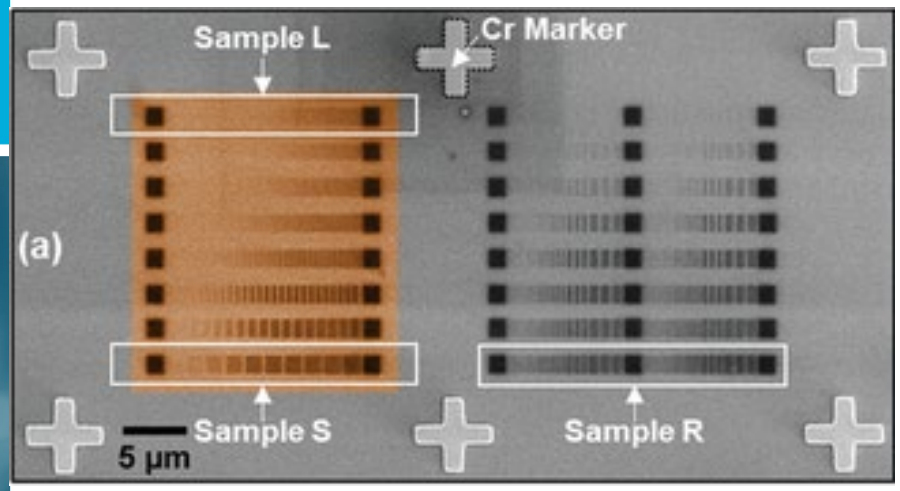
X-ray Imaging Technique Highly Sensitive to Trace Impurities in a Crystal

3-ID
HXN



Scanning electron microscopy images show the silicon samples implanted with gallium ions (darker regions). The grayscale gradient is due, in part, to minor height differences caused by sputtered silicon atoms.

Masteghin, M.G., Gervais, T., Clowes, S.K., Cox, D.C., Zelyk, V., Pattammattel, A., Chu, Y.S., Kolev, N., Stock, T.J.Z., Curson, N.J., Evans, P.G., Stuckelberger, M., Murdin, B.N. *Small Methods* May 1:e2301610 (2024). doi: 10.1002/smtd.202301610.

Work performed in part at NSLS-II

Scientific Achievement

Scientists used X-rays to detect tiny clusters of gallium atoms implanted within a pure silicon crystal.

Significance and Impact

This level of detection sensitivity could help scientists harness the potential optoelectronic and quantum properties of impurities/dopants, laying a foundation for new technologies.

Research Details

- Silicon samples were studied in part at NSLS-II's HXN beamline using high-resolution X-ray fluorescence (XRF) microscopy.
- The technique was sensitive down to about 650 gallium ions; in quantum materials, this level of chemical and structural characterization of atomic impurities was not previously known.
- The team is hoping to use upgraded light source facilities to improve the resolution to detection of a single atom.

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