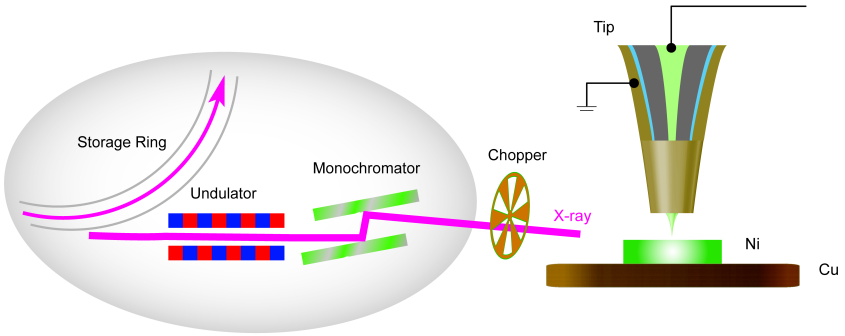
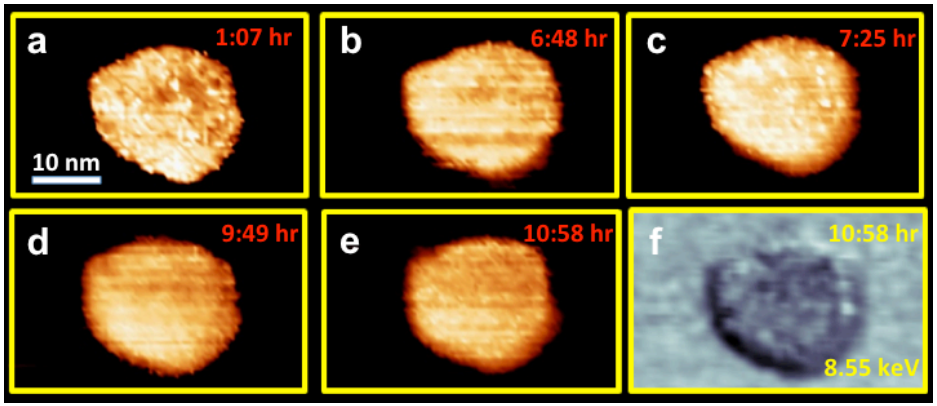
Hard X-ray beam damage study of monolayer Ni islands using SX-STM



SX-STM combines synchrotron X-rays with scanning tunneling microscopy.



a-e, STM Topography images of a Ni cluster upon continuous X-ray illumination with X-rays (8.45-8.88 keV). f, Chemical contrast image obtained at 8.55 keV after 10 h and 58 min X-ray illumination.

Scientific Achievement

The SX-STM technique combines synchrotron x-rays (SX) and scanning tunneling microscopy (STM). Matter-beam interaction can be studied *in situ* with ultra-high spatial resolution.

Significance and Impact

Beam damage introduced by X-ray beams is a significant challenge in materials science, biology, and other fields. So far, beam damage could only be studied *indirectly* (e.g., changes in diffraction peaks). SX-STM allows to *directly* see the surface during illumination; thus, study damage *in situ*.

Research Details

- Submonolayer of Ni deposited onto clean Cu(111).
- Sample continuously illuminated for about 11 h.
- During irradiation tip scanned across the surface to monitor changes in shape an volume.
- Photon energy: 8.45-8.85 keV
- Flux: 3×10^{13} photons s^{-1} mm^{-2}
- X-ray illumination does not cause damage on Ni islands.
- Utilized APS/CNM beamline ID-26.

N. Shirato, M. Cummings, H. Kersell, Y. Li, B. Stripe, D. Miller, D. Rosenmann, S.-W. Hla & V. Rose, Mater. Res. Soc. Symp. Proc. 1754, opl.2015.114 (2015).

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