

# CHALLENGES IN ABBERATION CORRECTED OFF-AXIS ELECTRON HOLOGRAPHY OF LAYERED TRANSITION METAL DICHALCOGENIDES

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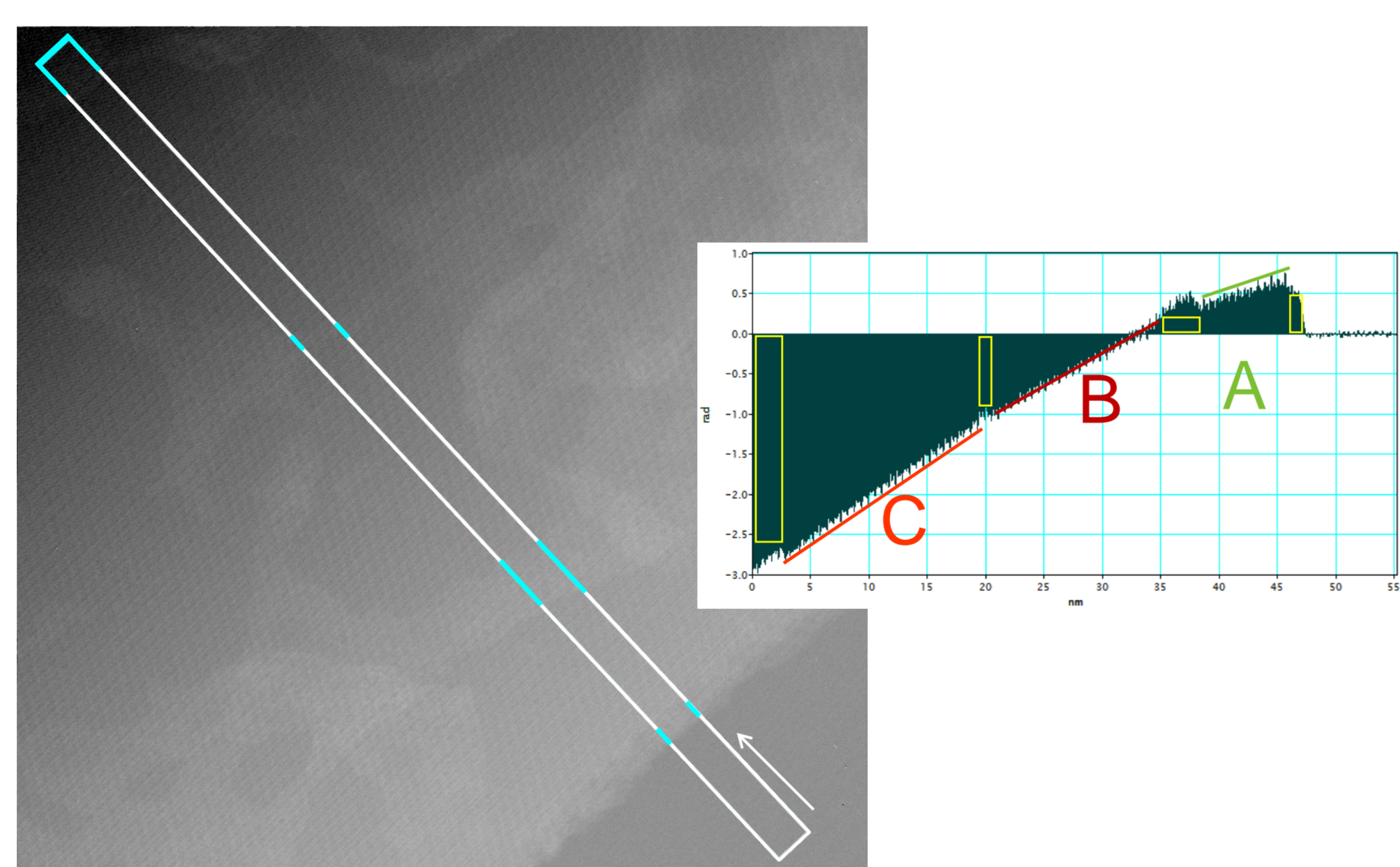
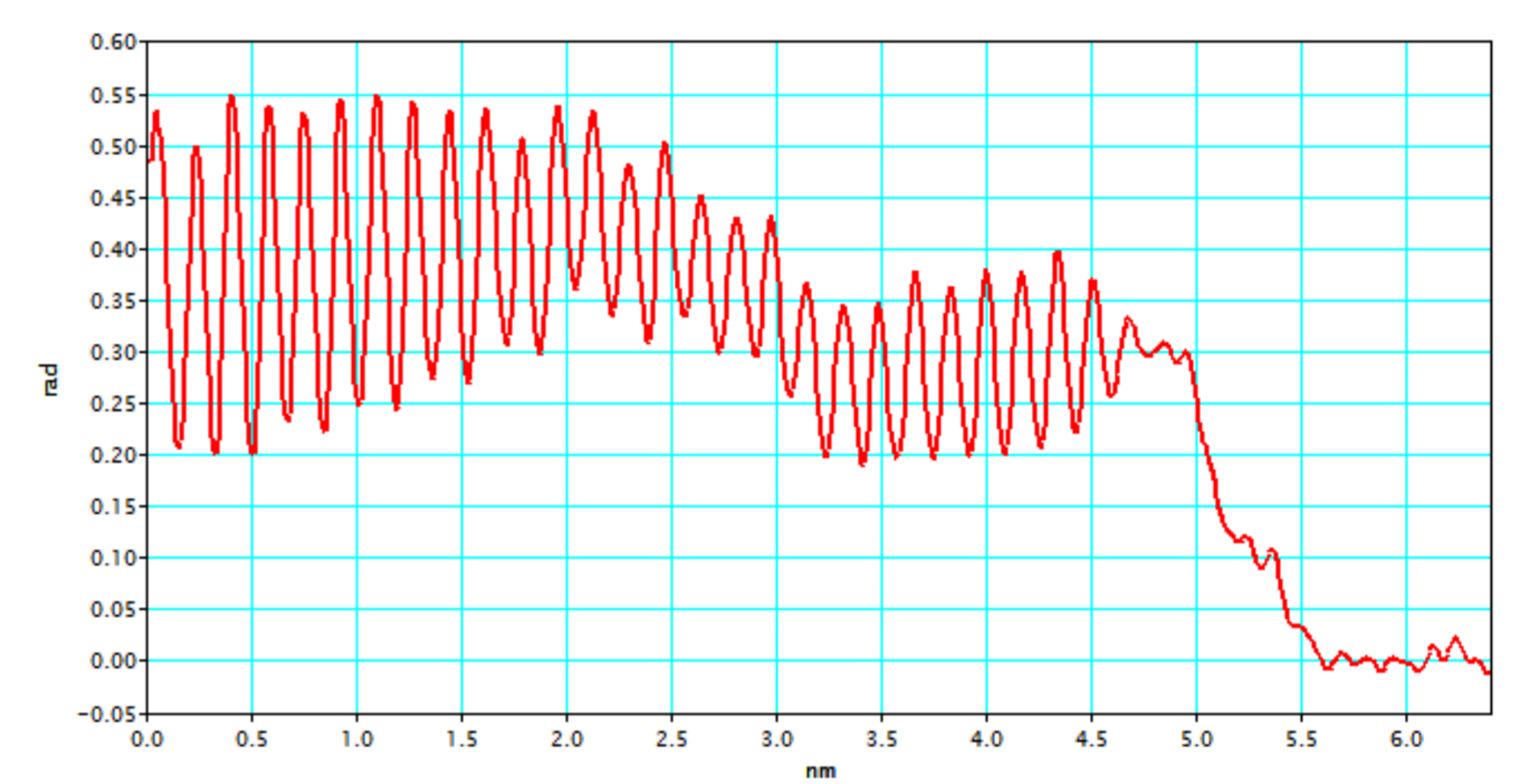
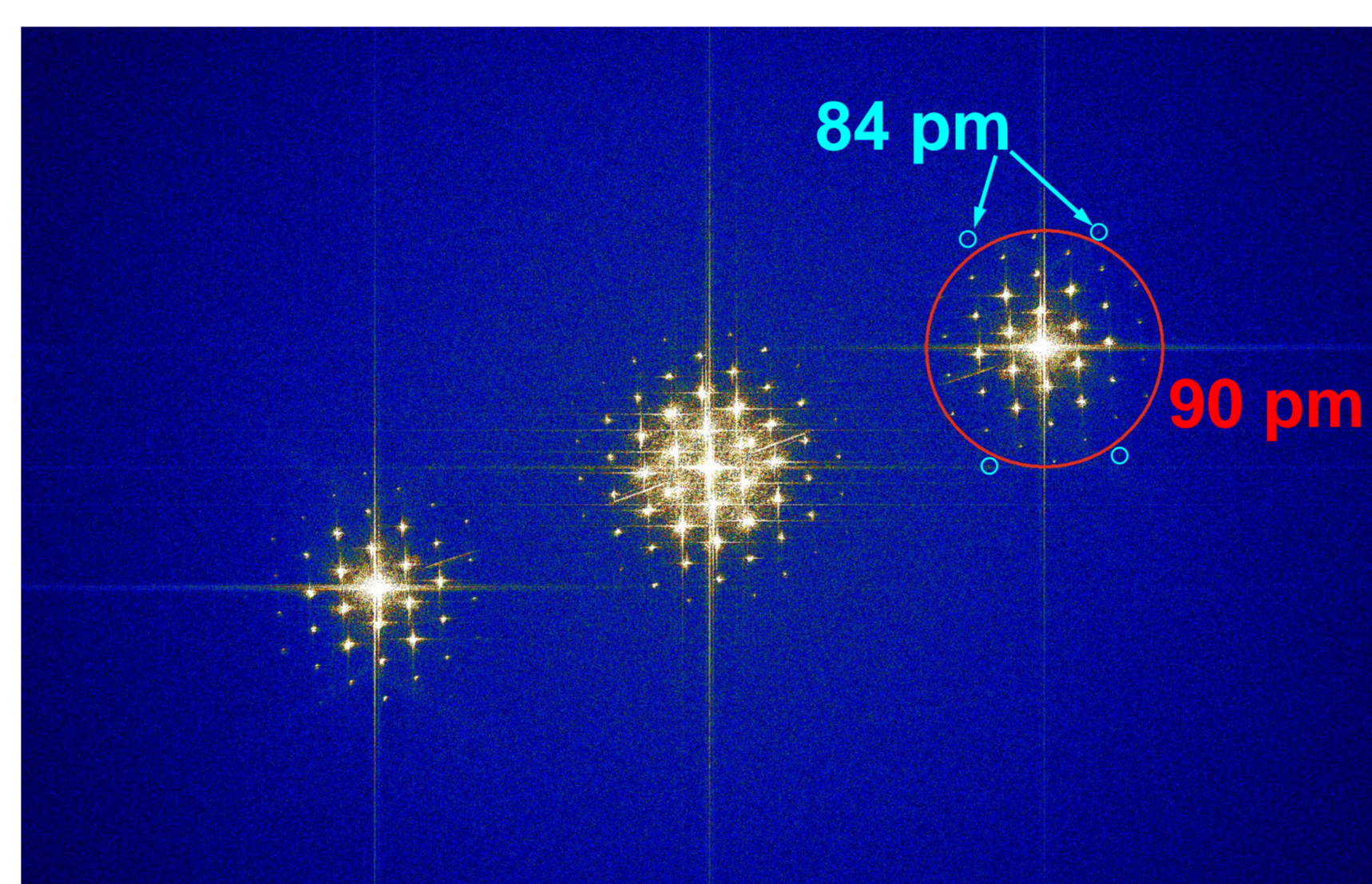
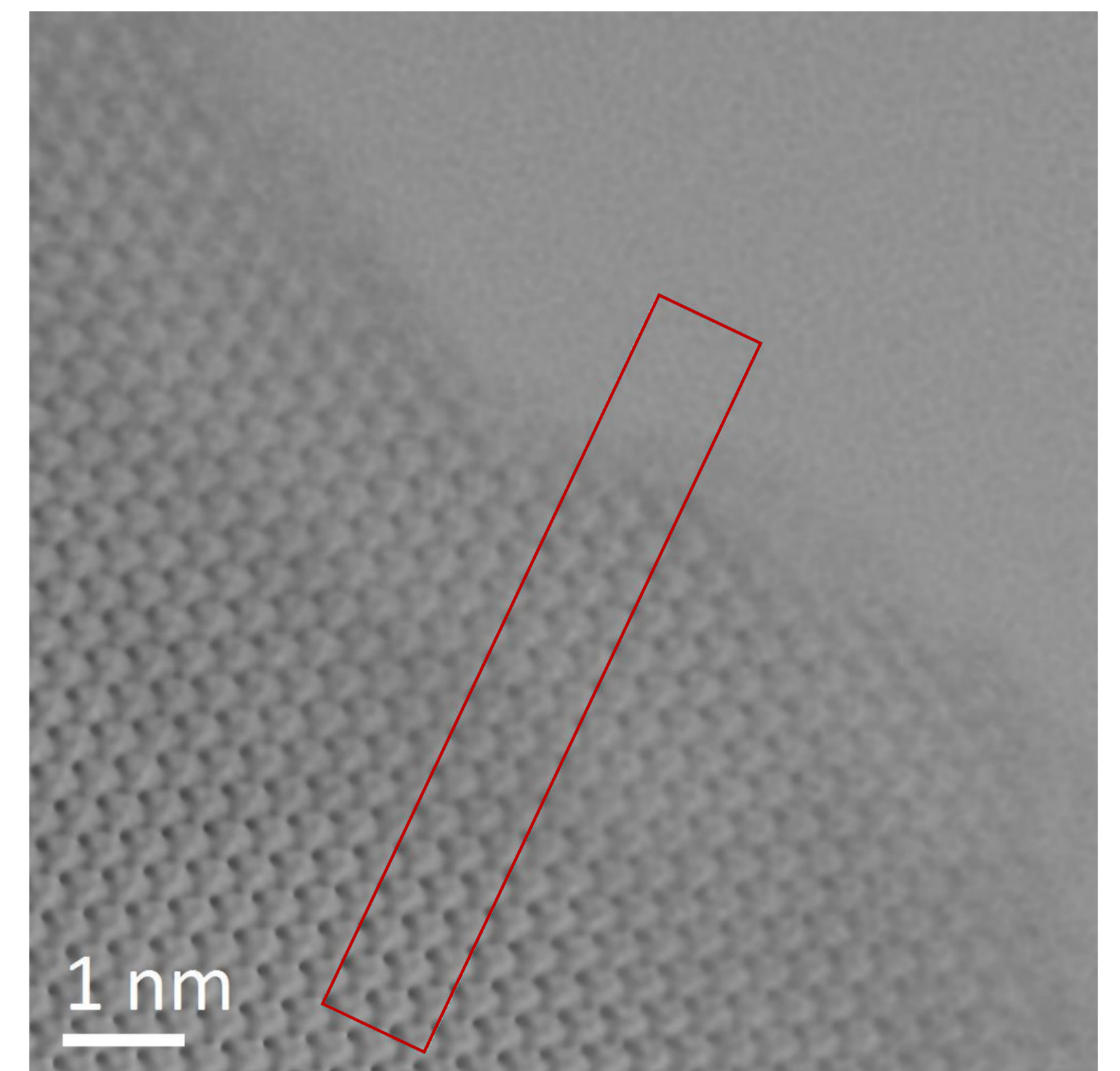
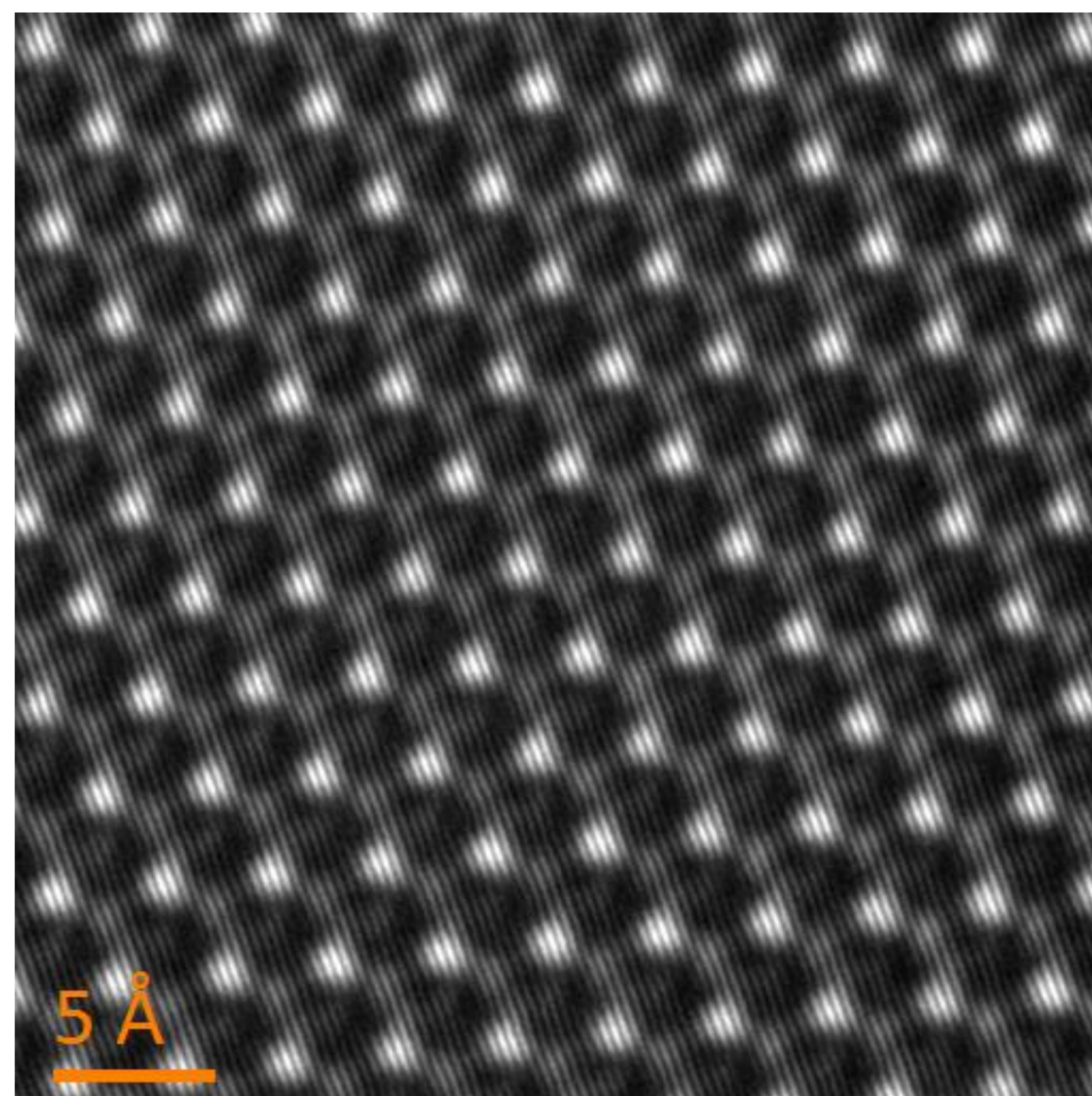
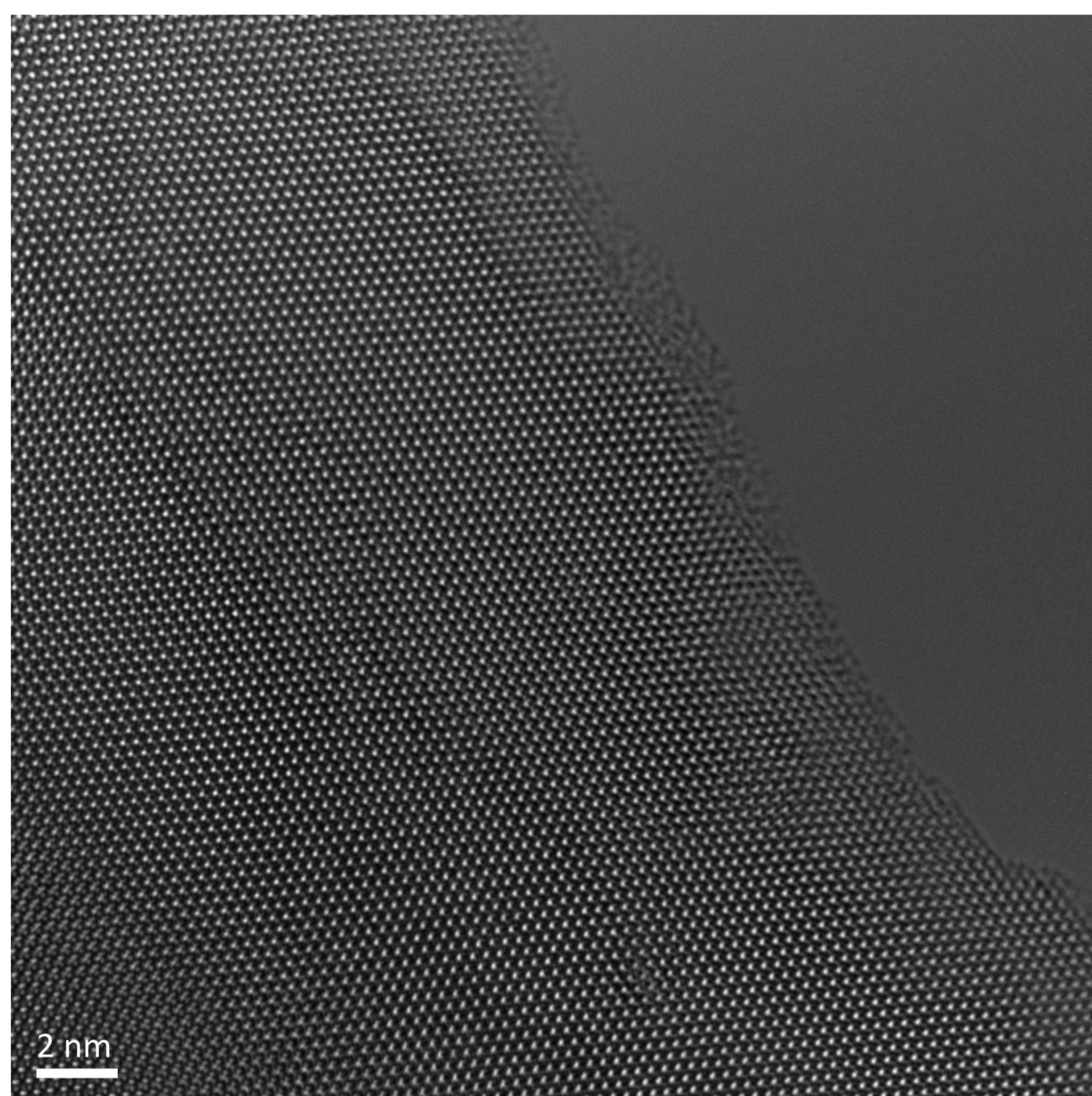
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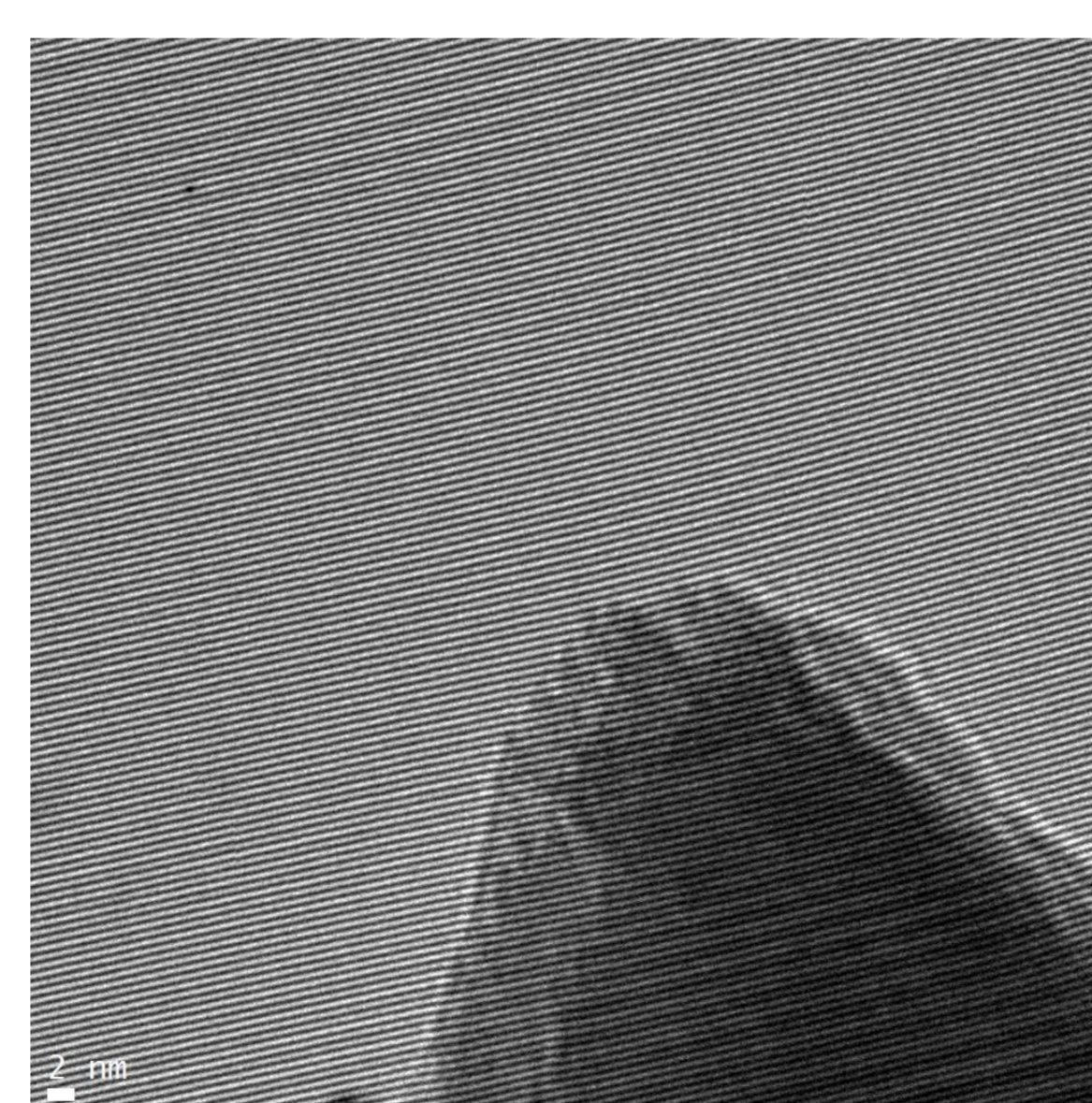
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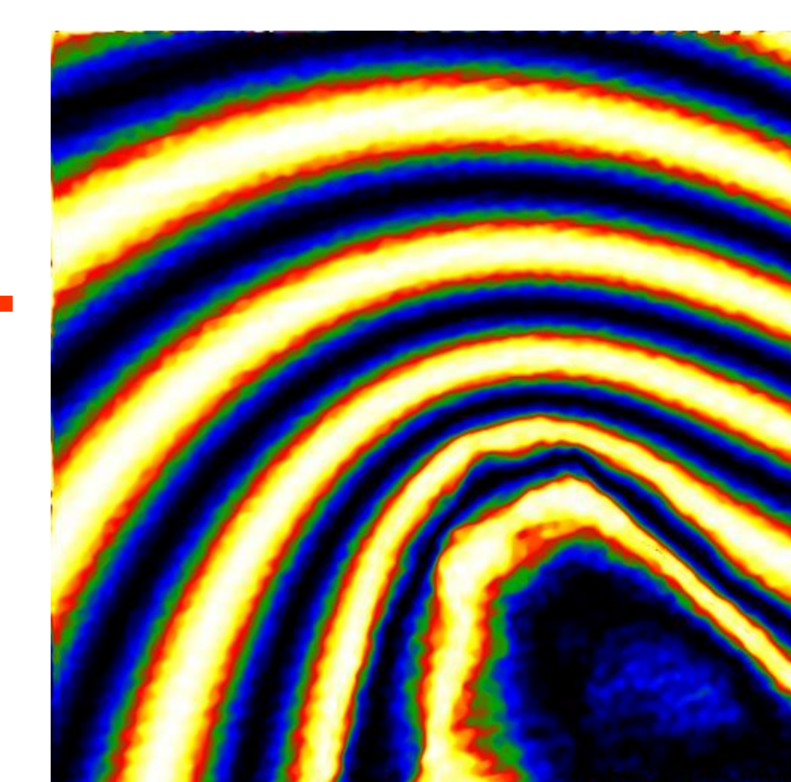
Off-axis electron hologram of an MoS<sub>2</sub> flake recorded at 80 kV (below) and a magnified region (right). The Fourier transform of the hologram shows 84 pm spacings. Phase images suggest that the sample contains 2-3 monolayers of MoS<sub>2</sub> and that its edge is slightly contaminated.



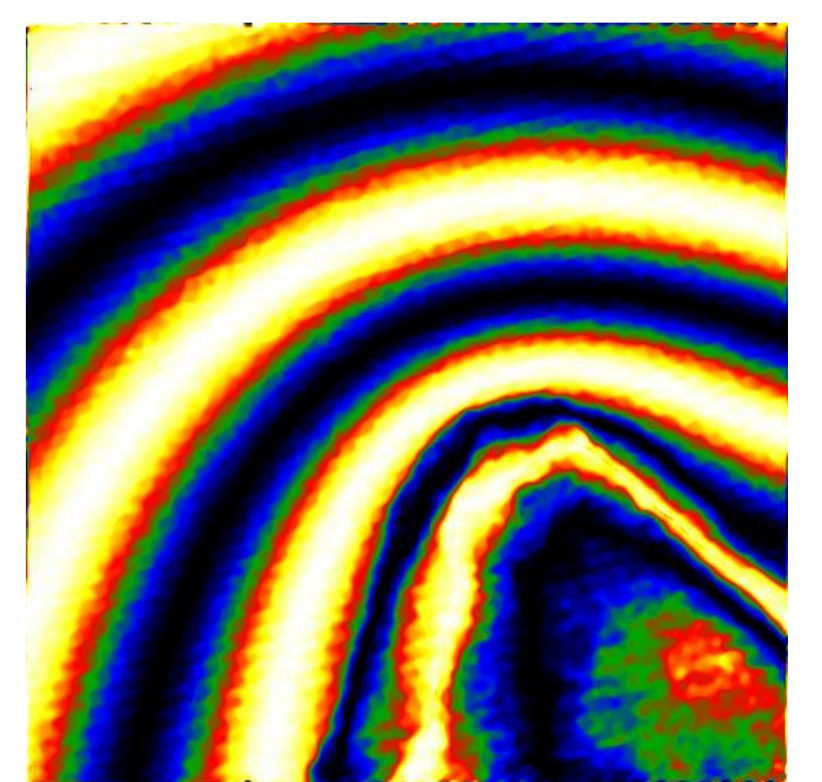
Phase image of a 2-monolayer ReS<sub>2</sub> flake recorded at 50 kV showing electron beam induced charging both at the specimen edge and at the positions of contaminated regions.



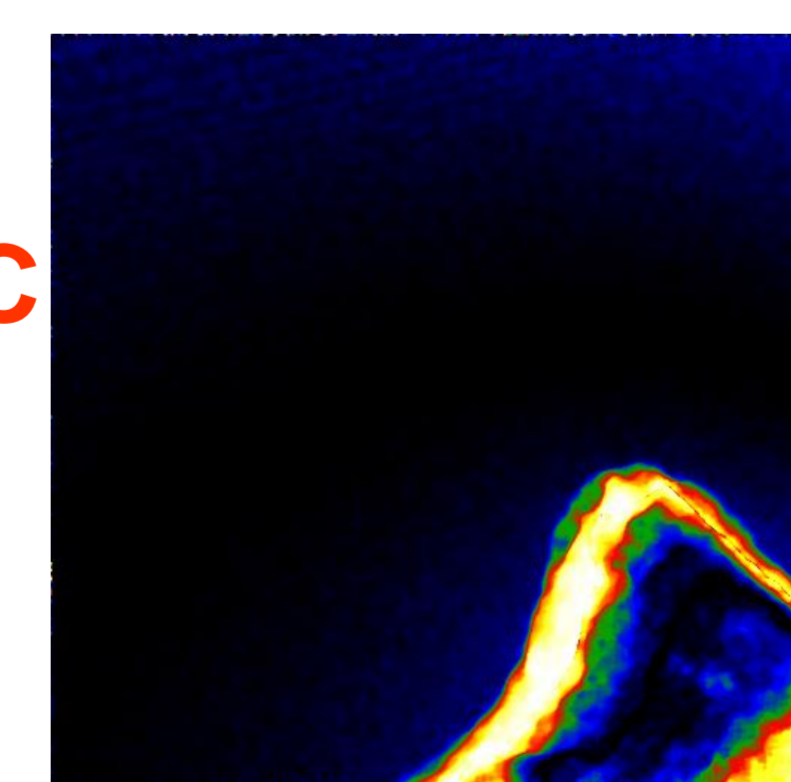
R.T.



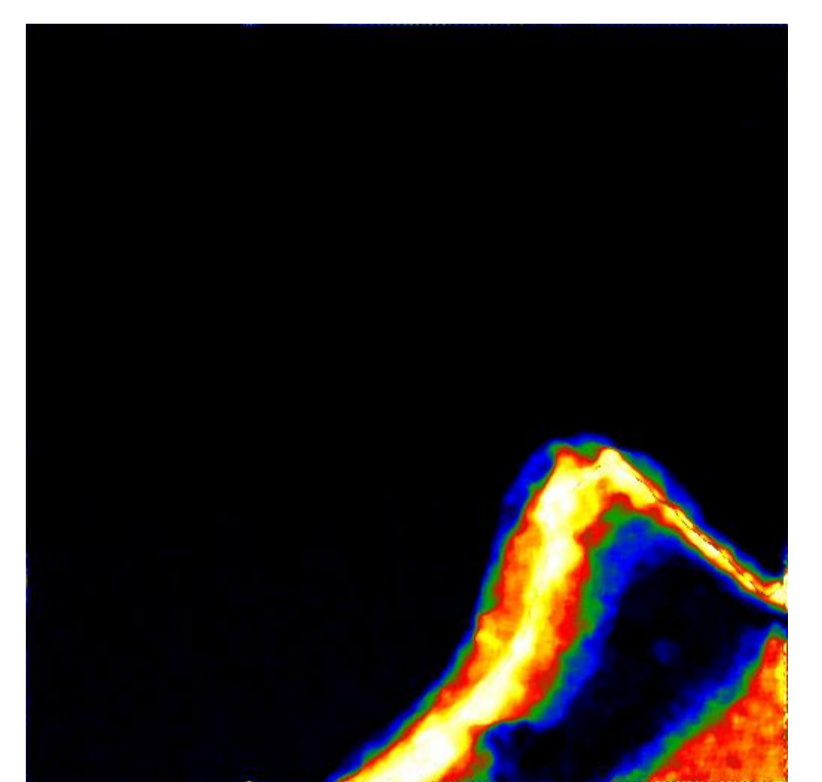
200°C



400°C



600°C



Electron holography of a WS<sub>2</sub> flake recorded at 60 kV during heating, showing a decrease in electron beam induced charging with increasing specimen temperature.

## Summary and Conclusions

- A wide range of two-dimensional transition metal dichalcogenides with nominal composition MX<sub>2</sub> (M: Mo, W, Re; X: S, Se) has been studied using medium and high resolution off-axis electron holography in spherical and chromatic aberration corrected transmission electron microscopes at accelerating voltages of 50, 60 and 80 kV.
- Possible challenges in such measurements include contamination, electron beam induced charging, stability of the sample and the instrument, residual aberrations and *in situ* damage (e.g., edge metallization, amorphization and sputtering of atoms from the surface).