Moving atoms imaged with aberration corrected focal series

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Introduction

Aberration corrected focal series reconstruction allows us to image individual atomic columns in many structures. For reliable reconstruction the structure must remain the same throughout the focal series. But for many materials we find there are considerable structural changes between each image in the series.

Aberration corrected focal series reconstruction provides a means to study these changes.

All aberration corrected images were taken at 200kV on the JEOL 2200 FEGTEM at the Department of Materials, Oxford University.

Goethite, FeO(OH)

Original images from focal series of Goethite

Atomic rearrangements are visible throughout series, especially in the circled areas

Au on CeO₂

Atomic columns at edge of CeO₂ look very plausible...

Reconstructed phase shows the average positions of the atomic columns over the focal series.

Conclusions

The wavefunction recovered using focal series reconstruction is an average of the images in the focal series. It will not be valid if there is atomic rearrangement during the series.

Atomic motion can be determined from individual members of a focal series either by comparison with other members or by comparison with images calculated from the restored wavefunction.

Acknowledgements

I would thank the following for provision of samples and acquisition of images: Jan-Dierk Grunwaldt, Steen Mørup, Daniel Madsen, Cathrine Frandsen, Crispin Hetherington, Shery Chang and Angus Kirkland