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A new method of processing and analysing electron diffraction patterns is presented that may have numerous analogues in other areas. It is demonstrated here in quantitative convergent beam electron diffraction (QCBED), for very precise measurements of structure factors. The technique maximises the sensitivity of structure factor measurement from diffraction data by almost completely eliminating the diffuse background contributed by inelastic scattering processes, most notably, thermal diffuse scattering (TDS). This is demonstrated in fig. 1. The present work is an extension to [1] and covers both energy-filtered and unfiltered CBED.

[1] P.N.H. Nakashima, Phys. Rev. Lett. 99 (2007), 125506.

[2] Thanks to A. Prof. J. Etheridge, Prof. A. Moodie, A. Prof. A. Johnson, Dr. V. Streltsov, the Australian Research Council (DP0346828) and the Australian and Victorian Partnerships for Advanced Computing.

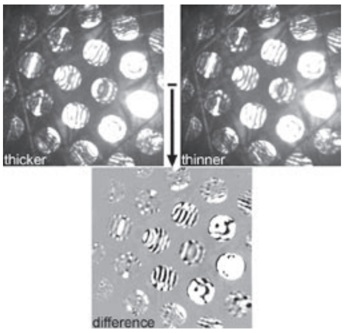


Fig. 1: Two zero-loss-filtered CBED patterns (6eV slit width) from different thicknesses of corundum. The background (outside the discs) in both patterns still contains significant signal due to inelastic scattering (mostly TDS), which is almost completely canceled in the difference pattern.

Keywords: inelastic scattering, thermal diffuse scattering, accurate structure factors

## P19.01.03

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### Automatic space group determination using precession electron diffraction patterns

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A set of algorithms for automatic High Order Laue Zone (HOLZ) indexing and possible set of space groups extraction were developed and implemented in the "Space Group Determinator" program. The symmetry analysis is performed using Morniroli-Steeds tables [1,2]. The developed program becomes extremely useful for the analysis of precession electron diffraction patterns (PEDs) [3]. "Space Group Determinator" was successfully tested on both simulated and experimental diffraction patterns with different zone axis orientations [4]. There are several advantages using PEDs: - The intensities extracted from PEDs are less dynamical, especially for main zone axes; - There are more reflections with higher resolution visible (depending on the precession angle); - The width of a HOLZ band (if visible) can be significantly larger than on a corresponding SAED pattern. The last statement is especially important for the correct space group or set of space groups determination. The possibility to observe several reflection lines within HOLZ makes the plane lattice shifts extraction easier. The knowledge of FOLZ shift with respect to the ZOLZ and the possible differences in periodicities provides very important information. The corresponding plane shifts in a* and b* directions between ZOLZ and HOLZ can be used together with tables from [1] for finding lattice centering, glide planes and partial symmetry symbol. This information can be treated systematically and implemented in the automatic procedure.

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3 R.J. Vincent, P.A. Midgley, Ultramicroscopy 53, 3 (1994), p. 271-282.
4 P. Oleynikov, PhD thesis, Stockholm University, (2006), p. 73-78.

Keywords: space groups, electron diffraction, precession

## P19.01.04

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### Determination of order parameter of single $L1_0$-FePd nanoparticle by nanobeam electron diffraction

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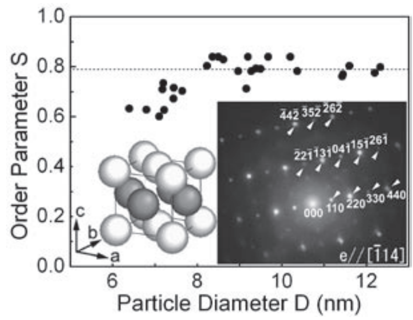
Long-range order (LRO) is the key issue in the structure-property relationships of the hard magnetic FePd nanoparticles with the $L1_0$ structure. In this study, we introduced a new technique to determine the LRO parameter of single FePd nanoparticle using nanobeam electron diffraction (NBD). The LRO parameter was determined by quantitative analysis of NBD intensities recorded by imaging plates together with intensity calculations considering the multiple scattering of electrons. In taking NBD patterns, hh0 systematic reflections were excited using a JEOL 3000F transmission electron microscope. Specimen thickness was evaluated by electron holography. The obtained LRO parameters of nanoparticles larger than 8 nm are distributed around the average LRO parameter (S=0.79) determined by selected area diffraction. In contrast, the LRO parameters gradually decrease as the particle size decreases below 8 nm (S=0.60-0.73). Experimental conditions required for NBD analysis are presented and the possible experimental errors are discussed. Attached figure shows the size dependence of the LRO parameters. A schematic of the $L1_0$ structure and an example of NBD pattern are shown in the inset.




Keywords: microdiffraction, ordered structures, nanoparticles

## P19.03.05

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### Contrast reversal of unindexed Kikuchi lines

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Kikuchi patterns can contain the unindexed line which runs along the middle line of a Kikuchi band and cannot be indexed as a Kikuchi lines. It appears as an excess, deficient or excess-deficient line

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