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Application of a difference electron nanoscope (DEN): Correlation between 3D magnetical structures of synthetic fayalite with synchrotron and neutron diffraction and mössbauer spectroscopy part II

Werner Lottermoser
Salzburg University, Austria

The evaluation of a 3-dimensional orientation of magnetic moments in solids is still a challenging problem in modern solid state physics and crystallography. Common methods to arrive at this goal are neutron diffraction, magnetometry and Single Crystal Mössbauer Spectroscopy (SCMBS). However, each of these methods have their limitations, viz. antiphase domains, magnetical impurities a.s.o. X-ray and synchrotron diffraction may provide valuable insights in crystallographic structures, but the separation of the magnetically effective 3d electrons is hardly possible with the latter methods. The synthetic fayalite Fe_2SiO_4 is a model system for a rather complicated 3D magnetic structure (collinear antiferromagnetic AF on the two relevant crystallographic sites at 65K but canted only on the M1 site with a temperature-dependent canting angle below 65K). These neutron diffraction results could be verified by SCMBS and DFT calculations via the determination of the electric field gradient efg with high accuracy. By the recently presented Difference Electron Nanoscope (DEN) we are now able to combine spectroscopic and diffractometric data in order to see this efg together with surrounding 3d-electron clouds floating in the fayalite unit cell and the relevant internal magnetic fields correlated with the moments. The previously presented 3D images for the M1 position are herewith completed for the M2 site.

Biography

Werner Lottermoser has completed his thesis work about neutron diffraction and magnetism of special silicates from Francfort University (Germany) and University lecturing qualification on Single Crystal Mössbauer Spectroscopy (SCMBS) in 1996 from Salzburg University (Austria). He is now working on sub-nanometric imaging, nanomaterials and materials for industrial applications. He has published more than 65 papers in reputed journals and 150 abstracts and has been serving e.g. for one year as a referee board member at the *Journal of Physical Chemistry A*. Recently, he was awarded the Austrian Staatspreis for Innovation together with AB-Microelectronics, Salzburg.

werner.lottermoser@sbg.ac.at

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