Magnetic Quantitative Texture Analysis (MQTA) using neutron diffraction

D. Chateigner, F. Léon, B. Ouladdiaf
[1] *CRISMAT-ENSICAEN, Univ. Caen Basse-Normandie, Caen, France*
[2] *ILL, Grenoble, France*

The present work is devoted to the study of Magnetic Quantitative Texture Analysis (MQTA), which characterizes magnetic moment distributions of magnetic materials, and investigates the links between magnetic signals, crystallites and microstructures.

The analysis was carried out on the new Curved Area Position Sensitive detector of the D19 beamline at ILL, Grenoble, which spans 120° in 2θ and 30° in χ. Indeed, to target MQTA, weak neutron magnetic difference signals have to be measured using large solid angle detectors to reduce acquisition times. This is indeed necessary when using unpolarised neutron beams as in this study. A special magnetic sample holder was developed which allows application of a magnetic field which is fixed relative to the sample when this latter rotates in the Eulerian cradle, and with a maximum field of 0.3T applied to the sample.

Starting from an isotropic magnetic state, we first measured the pole figures at zero field of a <110> fibre textured iron sample. We then applied a 0.3T field without sample dismounting, and worked out difference pole figures. The initial isotropic contribution of the magnetic scattering was calculated using the summed diagrams and Fullprof. Both latter steps were used to construct on one hand the total magnetic scattering pole figures, and on the other hand the scattering polarization pole figures. Using the WIMV approach we then refined the magnetic ODF, $f_m(g)$, and the magnetic scattering polarization ODF, $\Delta f_m(g)$, respectively accounting for the total magnetic scattering signal and for the magnetic scattering reorientation. We illustrate on the iron sample how one can construct from the total magnetic pole figures, the 3D orientation of the magnetic moments.