Poster Presentation

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Reorientation of α-Fe2O3 crystallites in an external magnetic field

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The magnetic interaction between the crystallites of weak ferromagnetic α-Fe2O3 has been studied by combining SR based X-ray diffraction with an externally applied magnetic field. The measurements were performed with several polycrystalline α-Fe2O3 [1,2] samples (dry or in suspensions) placed in a half-filled cylindrical container in ambient conditions. The axis of the cylindrical container was oriented vertically parallel to the applied dc magnetic field. The polycrystalline sample had a free surface, so the α-Fe2O3 crystallites were free to move. The full Debye-Scherrer diffraction rings were measured with a 2D pixel detector at the beamline ID-15B at ESRF. In the absence of the magnetic field the intensity distribution over azimuthal angle was a uniform, i.e. there was no texture. The applied maximal field, B=0.9T was too small to change the magnetic ordering of α-Fe2O3 but it was sufficiently strong to reorient large amount of crystallites in order to minimize the angle between their ferromagnetic moment direction and the external field. Pronounced texture patterns with clear maxima in the angular distribution of the intensity across each Debye-Scherrer ring were observed. The observed textured intensity distribution was analyzed quantitatively by using a model based on the magnetic anisotropy observed in single crystals of α-Fe2O3. The analysis yielded two important parameters: (i) the width of the angular distribution of the ferromagnetic moments directions around the external field direction, and (ii) the relative quantity of the crystallites that did reorient in the external field. The α-Fe2O3 samples were also characterized with TEM technique. The analysis of X-ray and TEM studies provide new conclusions about the magnetic interaction between the α-Fe2O3 crystallites [3]. The proposed measurement technique can be applied to study other weak ferromagnetic materials.

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