



Magnetic phase transitions in frustrated epsilon-Fe₂O₃ polymorph

Monday 20 March 2023 16:00 (2 hours)

The epsilon phase of Fe₂O₃ (ϵ -Fe₂O₃) presents captivating properties and it is receiving extraordinary attention due to its great application potentials. It stands out for its huge coercive field (up to 2 T at room temperature), millimeter-wave ferromagnetic resonance, remarkable non-linear magneto-optical effect, magnetoelectric coupling [1], and room temperature ferroelectricity [2]. It has been much less studied than other iron (III) oxides because its formation requires special conditions [1].

ϵ -Fe₂O₃ presents a complex noncentrosymmetric structure (Pna2₁) with three distinct octahedral and one tetrahedral environments for Fe sites. We present a neutron-based investigation on the rich magnetic phase diagram and properties of geometrically frustrated ϵ -Fe₂O₃ nanoparticles. The nature of the incommensurate magnetic order, attributed by some authors to a spiral ground state [5], was investigated in zero and applied magnetic fields, and reinterpreted in the light of the models confronted to neutron data [6]. The study illustrates the interplay between the huge magnetic anisotropy, frustration and the stabilization of the super-hard ferrimagnetic phase in the 150-500 K interval.

- [1] M. Gich et al., Nanotech. 17, 687 (2006).
- [2] M. Gich et al., Adv. Mater. 26 (2014) 4645.
- [3] J. A. Sans et al. Nature Comms (2018), 9, 4554.
- [4] J.L. García-Muñoz et al., Chem. Mater. 29, 9705 (2017)
- [5] Yu. V. Knyazev et al. Phys. Rev.B 101, 094408 (2020).
- [6] A. Romaguera et al., submitted

Authors: Dr ROMAGUERA, Arnau (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC)); Ms KHANAM, Naureen (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC)); Dr MA, Zheng (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC)); Dr HERRERO-MARTÍN, Javier (CELLS-ALBA Synchrotron); Dr RODRÍGUEZ-VELAMAZÁN, J. Alberto (Institut Laue-Langevin); Dr GICH, Martí (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC)); Prof. GARCIA-MUÑOZ, Jose Luis (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC))

Presenter: Prof. GARCIA-MUÑOZ, Jose Luis (Institut de Ciència de Materials de Barcelona (ICMAB-CSIC))

Session Classification: Poster Session MONDAY

Track Classification: Magnetism, Superconductivity, Topological Systems, Magnetic Thin Films and other electronic phenomena