MITT.ÖSTERR.MINER.GES. 149 (2004)

EPR STUDY AND MAGNETIC INVESTIGATION OF SYNTHETIC HEMATITE, α-Fe_2O_3

Carbone, C.[1], Di Benedetto, F.[2], Marescotti, P.[1], Martinelli, A.[3], Lima, N.[4], Pardi, L.[5], Romanelli, M.[4], Sangregorio, C.[4] & Sorace, L.[4]

[1] DIP.TE.RIS., Università di Genova, C.so Europa, 26 – 16132 Genova
[2] Museo di Storia Naturale, Università di Firenze, Via G. la Pira, 4 – 50121 Firenze
[3] INFM-LAMIA, C.so Perrone, 24 - 16152 Genova
[4] UdR INSTM-Dip. Chimica, Università di Firenze, Via della Lastruccia, 3 – 50019 Firenze
[5] I.P.C.F.-C.N.R. Area della Ricerca, via G. Moruzzi, 1 – 56124 Pisa
e-mail: carbone@dipteris.unige.it

Hematite (α-Fe_2O_3) belongs to the iron oxides group and is widely distributed in nature. The hematite structure can be described as corundum type, and consists of an arrangement of Fe^{3+} ions in octahedral coordination with oxygens in hexagonal close-packing.

Hematite is an antiferromagnetic mineral with Néel temperature T_N = 960 K and presents a first-order magnetic transition at T_M = 265 K, called Morin transition. Below this temperature the spins are aligned along the *c*-axis and hematite is antiferromagnetic; above T_M the spins lie in the basal plane of the crystal and show a weak ferromagnetism due to a slight spin canting out of the basal plane (DUNLOP & ÖZDEMIR, 1997). Despite its complex magnetic behaviour has been widely investigated, some questions, such as the origin of memory effect when it is thermally cycled through T_M, are still matter of debate (DE BOER et al., 2001).

In this contribution we present a thorough magnetic study on a fine powdered sample of synthetic hematite using a superconducting quantum interference device (SQUID) magnetometer and electron paramagnetic resonance (EPR) at different frequencies (from 9.25 GHz up to 285 GHz). The structural characterisation of this sample was performed through powder XRD and TEM.

The use of multifrequency EPR to characterise nanostructured metal oxide based material is a novel approach that can provide new and unique insights of the properties of these minerals. The Morin Transition was observed by EPR, as well as its strong dependence on the applied field, which was confirmed by magnetisation measurements.

References

DE BOER, C.B., MULLENDER, T.A.T. & DEKKERS, M.J. (2001): Geophys. J. Int., **146**: 201-216.

DUNLOP, D.J. & ÖZDEMIR, Ö. (1997): Rock magnetism: fundamentals and frontiers. Cambridge University Press. 537 p.