

Poster Presentation

MS90.P15

Site-specific RXMS study on the magnetic electron of magnetite

M. Okube¹, S. Sasaki¹

¹*Tokyo Institute of Technology, Materials and Structures Laboratory, Yokohama, Japan*

Magnetite Fe₃O₄ is the best known magnetic mineral for its attractive properties for various magnetic applications. The magnetic moments of Fe atoms show a collinear ferrimagnetic ordering between tetrahedral A and octahedral B sites in an inverse spinel structure with the chemical formula of [Fe³⁺]_A[Fe²⁺+Fe³⁺]_BO₄. The distribution of the Fe²⁺ and Fe³⁺ over A and B sites is determined by a delicate balance of the crystal field. The geometrical environment of 3d transition metals strongly affects the distribution and the energy state of magnetic electrons which contributes magnetic moments. The resonant x-ray magnetic scattering (RXMS) allows us to make site-selective structural analysis with respect to the magnetic electron. In order to clarify the behavior of the magnetic electrons in magnetite, we carried out the energy-dependent RXMS near Fe K edge. Depends on the observation related to 3d-4p electric transition to empty bands of unpaired electron, we studied the orbital interaction and the density of state of magnetic electrons in A site and B site of magnetite independently. RXMS intensity measurements were performed by using Rigaku AFC-5u four-circle diffractometers at BL-6C of Photon Factory. Circularly-polarized X-rays were produced by a transmitted-type phase retarder of diamond (111). According to the X-ray magnetic circular dichroism (XMCD) spectrum at the Fe K edge, 48 x-ray energies to perform RXMS measurement were selected. The magnetic form factors for various energies were calculated from the difference in diffraction intensities between left- and right-circular polarized measurements. By examining the energy dependence of the resonant magnetic peaks, the density of state of 3d magnetic electron of Fe were obtained for A and B site through the experimental analysis. In the presentation, the interrelationship between the site geometry and the magnetic electrons in terms of energy state will be discussed.

Keywords: magnetite, resonant X-ray magnetic scattering, electron configuration