Therefore, our energy-selective intensity measurements were made to choose a positive-peak position of the dispersive XMCD, which locates in a wavelength of $\lambda = 1.7442$ Å ($E = 7.1082$ keV).

The synchrotron experiments on RXMS of magnetite were performed with a Rigaku AFC5 four-circle diffractometer in Photon Factory BL-6C, where monochromatized X-rays are reproduced with the circularly polarization by a diamond (001) phase retarder. A spherical crystal of 0.13 mm in diameter was mounted along the a_3 axis on the glass fiber on a rare-earth magnet. The crystal was grown from Fe_3O_4 powder in Pt-10 % Rh crucible by the Bridgman method in the CO-CO_2 atmosphere and provided by Drs. S. Todo and H. Kawata. The cell dimension is $a = 8.4000(3)$ Å (*s.g. Fd*-3*m*). At temperatures of $T = 125$, 200 and 300 K, integrated intensity data were collected at a scan speed of 0.5 °/min in ω. A total of 425 reflections was collected within the range of $2\theta \leq 100°$ and $-7 \leq h, k, l \leq 7$ and corrected for the angle-dependent polarization effect. Intensity difference ($I^+ - I^-$) between left- and right-circular polarizations extracts the RXMS effect and is roughly proportional to the real part of $F^*_{\mathrm{charge}}F_{\mathrm{spin}}$ in complex conjugation of crystal structure factors.

Difference-Fourier maps on targeted magnetic electrons were sybthesized from the F difference between left- and right-circular polarizations. With some replacements of calculated F_{calc} for observed one, the usual difference-Fourier formalism can be used for the difference in the electron density of $[\Delta\rho_{\mathrm{obs}}(\boldsymbol{r})^{\mathrm{left}} - \Delta\rho_{\mathrm{obs}}(\boldsymbol{r})^{\mathrm{right}}]$ [4]. Nonessential effects such as charge scattering and experimental errors can be cancelled out in the difference-Fourier synthesis. Thus, in this study difference-Fourier maps of magnetite were obtained as a function of temperature and will be discussed for the magnetic electron density at the electronic transition energy so far examined. Our results show that the appearance of positive and negative peaks are caused by magnetic unpaired 3*d* electrons around Fe atoms associated with neighboring oxygen and the other Fe atoms. It suggests the existence of the A-O-B super exchange interaction.

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Keywords: resonant_magnetic_scattering, electron_density, iron_oxide

MS48.P03

Acta Cryst. (2011) A**67**, C530

Magnetic structures of BaTiMFe$_{10}$O$_{19}$ (M = Mn, Co) by resonant magnetic scattering

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The magnetic structures of *M*-type $BaTiMFe_{10}O_{19}$ (M = Mn, Co) have been determined by the resonant X-ray magnetic scattering (RXMS) method [1-4], where the spin-orbit coupling gives magnetic resonance at the *K* edge through the superexchange interaction between 4*p* and 3*d* sates with 2*p* of oxygen atoms. Although barium hexaferrite $BaFe_{12}O_{19}$ has the strong uniaxial anisotropy in magnetization along *c* axis, the substitution of Fe^{3+} by Ti^{4+}/M^{2+} results in a weakening of the magnetic interactions. The structure analyses based on neutron diffraction [5] and RXMS [4] measurements have suggested that Ti^{4+}/Co^{2+}-substituted crystals have ferrimagnetic structures with the canting of the magnetic moments. It is considered that the array of magnetic moments among five cation sites is different between Ti^{4+}/Mn^{2+} and Ti^{4+}/Co^{2+} substitutions.

Synchrotron X-ray intensity measurements were made for single crystals of ferrimagnetic ferrites at BL-6C of the Photon Factory. X-ray magnetic circular dichroism (XMCD) and RXMS effects were examined with intensity differences between the right- and left-circular polarizations, produced by a transmission-type phase retarder of diamond (001). The XMCD measurements are important to pinpoint the photon energy required for RXMS, where a negative XMCD signal around $E = 7.123$ keV has a chemical shift between Ti^{4+}/Mn^{2+} and Ti^{4+}/Co^{2+} ferrites. By using a Rigaku AFC5 four-circle diffractometer, intensity measurements of RXMS for $BaTiMnFe_{10}O_{19}$ and $BaTiCoFe_{10}O_{19}$ were made in an ω–2θ scan mode at wavelengths of $\lambda = 1.7402$ Å ($E = 7.1245$ keV) and 1.7406 Å (7.1228 keV) at the Fe *K* edge, respectively.

Single crystals of ferrites were grown by a flux method. The crystal symmetry is hexagonal with the space group $P6_3/mmc$ and cell dimensions are $a = 5.9039(2)$ and $c = 23.2047(8)$ Å for Ti-Mn and $a = 5.8955(3)$ and $c = 23.205(2)$ Å for Ti-Co. The crystal structure can be built up with a sequence of spinel *fcc* blocks of $(Fe_6O_8)^{2+}$ and *hcp* blocks of $(BaFe_6O_{11})^{2-}$. Five independent Fe sites exist as tetrahedral $4f_1$, bipyramidal 2*b* and three octahedral sites of 2*a*, $4f_2$ and 12*k*. The cation distributions of the barium ferrites have been estimated from single-crystal X-ray diffraction data [6]. Spin orientations were estimated in the least-squares method based on an asymmetrical ratio $\Delta R = (I^+-I^-)/(I^++I^-)$, where I^+ and I^- are left- and right-circular polarized intensities, respectively. The degree of the spin canting for $BaTiMnFe_{10}O_{19}$ was determined in the least-squares calculations with resonant magnetic scattering factors, which was compared with that of $BaTiCoFe_{10}O_{19}$ in the relation between magnetic helices and cation substitution.

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Keywords: resonant_magnetic_scattering, magnetic_structure, barium_ferrite

MS48.P04

Acta Cryst. (2011) A**67**, C530-C531

X-ray magnetic diffraction and magnetic compton scattering of Pd-Co and Pt-Fe

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X-ray magnetic diffraction (XMD) experiment has been performed for Cu_3Au-type single crystal alloys of disordered Pd_3Co and ordered Fe_3Pt, and magnetic Compton scattering (MCS) experiment has been performed for Pd_3Co. The aim of this study is to estimate spin and orbital magnetic moments of the alloys. Electron probe micro analysis (EPMA) has shown that precise chemical composition of Pd_3Co is $Pd_{3.2}Co_{0.8}$. The XMD and MCS experiment were made on BL3C of