Influence of Microwave Irradiation on Magnetic Oxide Compact

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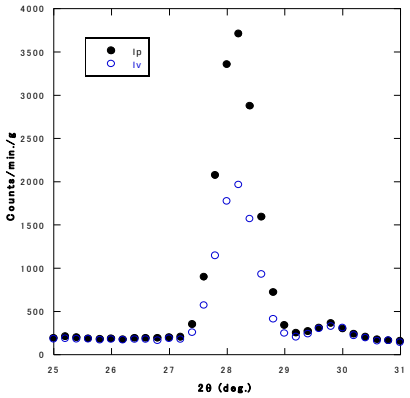
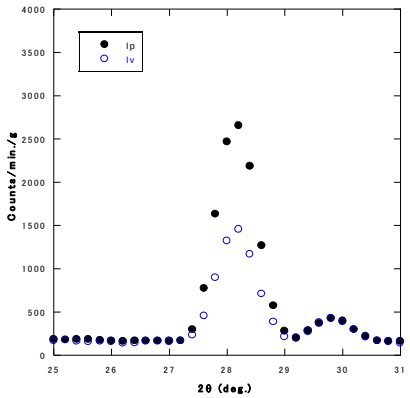
A new method to form nano-structures consisting of small magnetic domains of 5~20 nanometers with random orientations has been developed when some ferromagnetic materials are exposed to the magnetic field at microwave frequencies.[1] These domains spread beyond boundaries of starting crystals of several tens microns to millimeters as bulk materials. The series of experiments demonstrated that the irradiation of high frequency magnetic field couples to the electrons directly in the ferromagnetic material and that the localized hot spots were created and maintained for a significant period of time to reconstruct the micron order crystals into the continuous nano-magnetic domains.

For clear the mechanism of the non-equilibrium reactions by electromagnetic wave energy, we performed the polarized neutron diffraction measurements to determine the magnetic structures of the nano-domeins by the triple-axis spectrometer TAS-1 at JRR-3 (of Japan Atomic Energy Agency). As a result, the differrence of internsity measured by TAS-1 between sample heated by E-field and H-field of 2.45GHz microwave irradiration as showen in Fig.1.



(a) Sample heated by E-field



(b) Sample heated by H-field

Fig.1 Polarized neutron scattering profile by TAS-1.

References

[1]S.Takayama, K.Kakurai, M.Takeda, A.Matsubara, Y.Nishihara, J.Nishijo, S.Sano, N.Nishi, M.Sato, Nuclear Instruments and Methods in Physics Research Section A (NIMA) 600 (2009).