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Neutron Diffraction and Permeability Studies of Co_2Z-type Hexaferrite $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$

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Co_2Z-type hexagonal ferrite, $Ba_3Co_2Fe_{24}O_{41}$, is one of candidate materials for electromagnetic noise absorbers used in gigahertz region. We previously reported the effect of substitution of Sr for Ba of $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ (x = 0, 1.5 and 3.0) on permeability and magnetic structure[1]. In this paper, we report results of neutron diffraction and permeability measurement of $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ samples with x = 2.0 and 2.5 together with those with x = 0, 1.5 and 3.0 prepared in our previous study.

We have prepared the samples in conventional ceramic method. Figure 1 shows temperature dependences of canting angles from c-axis in $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$ which are determined from the Rietveld analyses of the neutron diffraction patterns obtained at different temperatures. The angle of each sample decreases with increasing temperature. As for the sample with x < 2.0, the magnetic moment lies in c plane (canting angle : 90°) at room temperature.

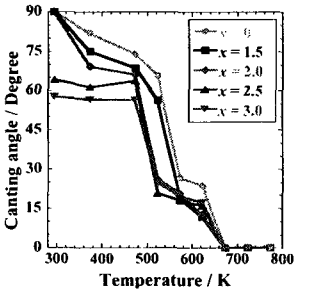

Fig. 1. Temperature dependence of canting angle of magnetic moment from c-axis for $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$.

Figure 2 shows the temperature dependence of magnetic moments of iron and cobalt ions in $Ba_{1.0}Sr_{2.0}Co_2Fe_{24}O_{41}$. Both the moment sizes decrease with increasing temperature. The moment of cobalt ion disappears at 523 K, where canting angle rapidly decreases as shown in Fig. 1. This suggests that canting of magnetization in Co_2Z-type hexaferrite arises from magnetic anisotropy of cobalt ion.

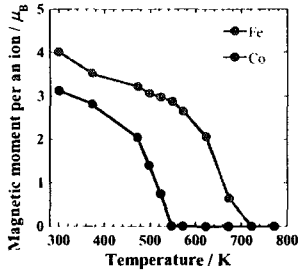

Fig. 2. Temperature dependence of magnetic moment sizes of iron and cobalt ions in $Ba_{1.0}Sr_{2.0}Co_2Fe_{24}O_{41}$.

Figure 3 shows the frequency dependence of the real part of permeability for $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$. The static permeability, μ_s', reaches 22 when x 2.0. This is higher than the highest value (μ_s' 21) reported for the Z-type ferrites[2]. Also x 2.0 sample gives at 550 MHz to 3 GHz higher imaginary permeability, μ'', than other samples.

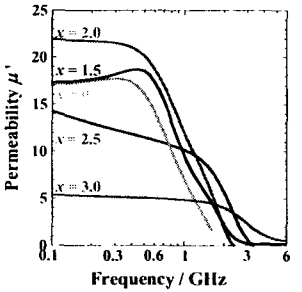

Fig. 3. Frequency dependence of the real part of permeability for $Ba_{3-x}Sr_xCo_2Fe_{24}O_{41}$.

Therefore, $Ba_{1.0}Sr_{2.0}Co_2Fe_{24}O_{41}$ is expected to be used as materials for gigahertz noise absorbers.

REFERENCES

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High Frequency Magneto-electric Properties of Composite Material Made of Soft Magnetic Ferrites and Hard Magnetic NdFeB

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The magneto-electric dynamics of composite material made of soft magnetic ferrites and hard magnetic NdFeB are studied. In this work, the nano-sized ferrites were synthesized by combustion method, and then were mixed with various amount (1, 3, 5%) of micro-sized NdFeB. The M-H behavior of the ferrites/NdFeB composites has displayed specific features of wasp-waisted hysteresis loops, correlated to the superposition of magnetization of hard and soft magnetic phases. The variation of magneto-impedance of composites has demonstrated that small amount of of NdFeB additive into ferrites can significantly effect the behavior of spectra. Mechanism of hard and soft magnetic interaction underlying for the magneto-electric dynamics is investigated. The results imply for high frequency device applications utilizing ferrites/NdFeB nano-composites.

Abstract submitted for the1st ISAMMA (International Symposium on Advanced Magnetic Materials and Applications) conference, to be held at the Hotel Shilla in Jeju island, Korea, during May 28-June 1, 2007.