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Preparation of High Performance Sr-Ferrite by Element Substitution

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원소치환에의한 스트론튬 페라이트의 고성능화

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I . INTRODUCTION

The Sr-ferrite magnets have been widely used in various motors. Recently, the commercial magnets for car motors require the more high properties magnets. Also, the improved magnets are demanded in the electric appliance industry. The general formula $SrFe_{12}O_{19}$, having a magnetoplumbite structure characterize a M-type ferrite magnet. [1,2] There are many methods to increase of residual induction (Br) and intrinsic coercive force (iHc), such as: ① control of the intrinsic magnetization or the anisotropy constant, ② increase of the sintered density, ③ control of the particle size and distribution after fine milling and ④ increase of the orientation in pressing etc.

Some studies have been carried out regarding the Sr-La-Co ferrites for the purpose of increasing the magnetic properties of Sr-ferrite magnet. [3,4] This work is to study the basic element substitution of Sr-ferrite. The effect of simultaneous substitution of La and other elements for the Sr ferrite magnet is also examined.

II . EXPERIMENTAL

These raw materials were weighed in the formula compositions. These were mixed in an attritor with water. Each of the mixed powders were calcined at electric furnace under air atmosphere, and then was crushed using a crusher mill. The magnetic properties of the calcined materials were measured by VSM, and SEM observed the morphologies.

The calcined powder was fine-milled with additives of SiO_2, and $CaCO_3$ etc. The milled slurry was formed into a disk shape in an external magnetic field which was applied in the thickness direction. The green bodies were sintered in air atmosphere. The magnetic properties of the sintered bodies were measured using a B-H curve tracer.

Ⅲ. RESULTS AND DISCUSSION

The XRD analysis revealed that all the phases were hexagonal. Therefore, the elements in Sr-ferrite may be substituted with no change of hexagonal structure. In case of the substitution of Mn and Ni for the elements of Sr-ferrite, the main peak indicated a relatively strong intensity, whereas the main peak of Cu substitution was somewhat deteriorated

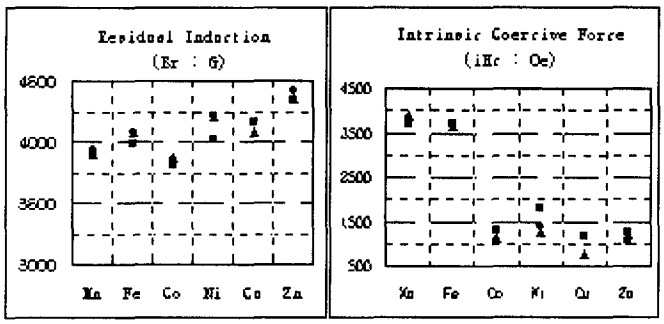

Fig. 1 Magnetic properties for the composition of $SrFe_{11.7}M_{0.3}O_{19}$.

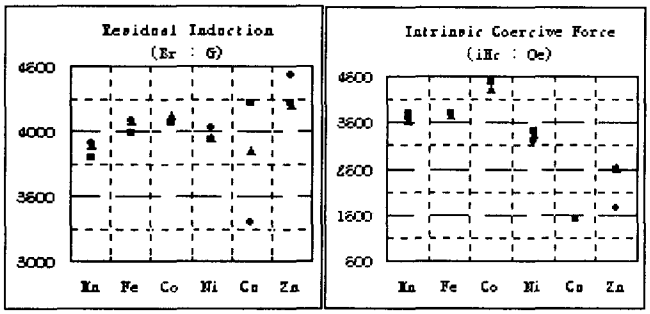

Fig.2 Magnetic properties for the composition of $Sr_{0.7}La_{0.3}Fe_{11.7}M_{0.3}O_{19}$.

Fig.1 and Fig.2 show residual induction (Br) and intrinsic coercive force (iHc) for the composition of $SrFe_{11.7}M_{0.3}O_{19}$ and $Sr_{0.7}La_{0.3}Fe_{11.7}M_{0.3}O_{19}$ respectively. [3,4] The magnetic properties of Sr ferrite substituted by only one element exhibited that the coercive force iHc of Co, Ni, Cu, and Zn substitution were drastically decreased, while the residual induction Br of Ni, Cu and Zn substitution were slightly increased. However, when using the La element as a charge compensation material, the intrinsic coercive force iHc was greatly enhanced by a La-Co substitution. In this experiment result, the sintered magnetic properties for the Sr-ferrite substituted with La-Co indicated that Br = 4.1 kG, iHc = 4.3 kOe. These results are similar to those of others [3,4] Therefore, in order to improve the magnetic properties, the additives need to be modified with the La-element substitution before milling, and the calcination condition should be optimized as well.

Ⅳ. CONCLUSION

1. The magnetic moment of each substitution element is considered to play a main role in the changing of residual induction for substituted Sr-ferrite. The coercive force of Sr-ferrite with an La-M substitution was increased more than those of Sr ferrite with only one M substitutions. This effect is ascribed to the fact that the La materials act as charge compensation. [3,4]

2. In the La-Co substituted Sr-ferrite; the sintered magnetic properties indicated that Br 4.1kG, iHc 4.3kOe.

3. In order to improve the magnetic properties of Sr ferrite, the calcinations condition should be optimized with the La-element substitution condition, and the additives condition before milling needs to be modified as well.

Ⅴ. REFERENCES

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