ELECTROMAGNETIC PROPERTIES OF COMPOSITE FINE POWDER SYNTHESIZED BY POLYCARBONSILANE PRECURSOR/ MAGNETIC POWDER

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SUMMARY: Magnetic fine powder whose electromagnetic parameters can be easily controlled was prepared by the polycarbonsilane precursor mixed with magnetic fine powder and subsequently heated at different temperatures. The phase composition and the electromagnetic characteristic of fine powder were analyzed. The processing parameters were optimized. The effect of the kind and the amount of the mixed magnetic fine powder, as well as the temperatures on the electromagnetic properties of the composite fine powder was studied. Under the processing routine presented in this paper, composite fine powder possessing different electromagnetic properties can be prepared.

KEYWORDS: magnetic fine powder electromagnetic parameters precursor

INTRODUCTION

With the improvement of high technology industry, intensive research is devoted to composite materials to obtain properties that cannot be achieved by any of the elemental parts acting alone[1].There are more and more requirement for the preparing technology of electromagnetic functional material.The production of composite fine powder whose electromagnetic property is easily changed has an important significance on magnetic recording materials. Composite fine powder has the special physical,chemical and magnetic properties.For example ,its static magnetic parameters and ambient temperature electrical resistivity can attain hundreds times of those of the magnetic metals. Various synthetic methods have been used to prepare composite fine powder[2].In this study, a new processing routine which is composed of chemical disproportion method and heat treatment is used to prepare composite fine powder.

EXPERIMENT

The magnetic fine powder was synthesized by a precipitation routine from a mixture of cobalt and ferrous chlorides,$CoCl_2 \cdot 6H_2O$ and $FeCl_2 \cdot 4H_2O$ taken in different ratio added into boiling potassium or chemical reduction solutions.In the process,vigorous stirring was

necessary. The samples were washed and mixed with polycarbonsilane. At different temperature, the mixture underwent heat treatment. All the specimen and their processing routine are showed in table 1.

Table 1 Different composite powder and their processing routine

specimen	Processing routine
1	The mole ratio of iron : Cobalt was 2:1,chemical precipitation.
2	The mole ratio of iron : Cobalt was 4:1,chemical precipitation.
3	The No.2 sample was treated one hour under 900°C.
4	The No.2 sample mixed with polycarbonsilane whose mass percentage was 20 percent treated 2h under 900°C.
5	The No.3 sample was ball milled.

At last, the samples were characterized by XRD and thermal gravimetric (TG) analysis. The static electromagnetic properties of the composite fine powder were studied.

RESULTS AND DISCUSSIONS

The XRD patterns of the samples 1,2,3 and 4 are given in table 2.

Table 2 X-Ray diffraction analysis results of the first four powders

Specimen	The phase analysis results
1	$CoFe_2O_4$,Co
2	$CoFe_2O_4$,CoFe
3	$CoFe_2O_4$,CoFe the amount is more than No.2 sample
4	Fe_3Si,Co_3C

The XRD patterns of the samples show that magnetic fine powder deposited from the reaction solution was amorphous material. They were crystallized through heat treatment. Composite fine powder consists of Fe_3Si, Co_3C and a little SiC. The more the amount of polycarbonsilane , the more the amount of the metal composition . The powder particle size is 50-200 nm.

From the TG-DTA analysis results, we can conclude that during the heat treatment process the sample weight was reduced to the 70 percent of its origin level. The reason is that the polycarbonsilane was disintegrated into free carbon and amorphous SiC at certain temperature, subsequently given out gases. In the 700-800°C range, the crystallographic structure of composite fine powder is stable.

Electromagnetic properties of the samples are showed in table 3.

Table 3 Static magnetic results of No.1--5 powders

specimen	Hc(Oe)	Ms(emu/g)
1	989	37.5
2	2260	52.3
3	294	71.9
4	265	82.1
5	417	72.0

Electromagnetic parameter results show that the electromagnetic characteristic of the samples is the best when the molar ratio of ferrous to cobalt was equal to 4 or 2 in metal-oxide series product which was precipitated from boiling potassium. The amount of Fe_3Si and Co_3C in the composite fine powder plays an important role in the magnetic properties of the composite fine powder. When the molar ratio of cobalt to ferrous was equal to 1:4,the coercive field of the fine powder can attain 2260 Oe. Its ambient temperature electric resistivity and static magnetic parameters could be adjusted by changing the molar ratio of reaction materials ,the mixing ratio of polycarbonsilane or the thermal process system.

CONCLUSIONS

Under the processing routine presented in this paper, the composite fine powder possessing different electromagnetic properties can be prepared. The composition , particle size and electromagnetic properties can be easily adjusted by changing the process parameters.

REFERENCES

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