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PERMANENT MAGNET MATERIAL HAVING STRONTIUM FERRITE BASE

Roger Frank Coe, Rednal, England, assignor to Joseph Lucas (Industries) Limited, Birmingham, England
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3 Claims

ABSTRACT OF THE DISCLOSURE

Up to 3% by weight of strontium phosphate is added to permanent magnet material of known form having a strontium ferrite base. The addition of the strontium phosphate is found to give considerably improved magnetic properties.

A permanent magnet material having a strontium ferrite base is known, and it is also known that additives of various kinds improve the properties of a magnet manufactured from such material. We have now found that the magnetic properties of a magnet formed from a strontium based material can be considerably improved if strontium phosphate is added to the starting material.

In one example, 439 grams of ferric oxide, 74 grams of strontium carbonate, 5.22 grams of calcium fluoride, 1.30 grams of aluminium oxide and 2.61 grams of strontium phosphate were wet mixed for two hours in proportions of 50% water by volume to 50% of the mixture. The mixture was then dried to provide a powder which was calcined at 1260° C. for one hour. After cooling, the powder was wet-ball milled using steel balls of $\frac{3}{16}$ inch diameter to a particle size less than 1 micron, the liquid medium being water together with a surface active agent, for example that sold under the trade name Daxad 30. This process was continued for 12 hours. The slurry was then wet pressed in a magnetic field of 8000 oersteds at a pressure of 3 tons per square inch, and was dried and sintered at a maximum temperature of 1230° C., and then cooled to room temperature. To avoid cracking of the magnet formed as a result of dimensional changes taking place in the sintering and cooling process, the heating and cooling were carefully controlled in known manner.

The aluminium oxide used in the mixture is a grain growth inhibitor and the calcium fluoride is a flux agent. These additives are known in themselves, but the presence of the strontium phosphate leads to greatly improved re-

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sults. The properties of a magnet of this general kind are assessed by quoting the values of the remanence B_r , and the field strength of disappearance of magnetisation or intrinsic coercivity H_C , and the values of these parameters in the example quoted were 4160 gauss and 3900 oersted respectively.

It is known that variation of the sintering temperature can improve the value of intrinsic coercivity at the expense of remanence or vice versa, and this variation occurs with or without the phosphate addition. By way of example, when the specific example mentioned above was repeated at a sintering temperature at 1200° C., the values of remanence and intrinsic coercivity obtained were 3890 gauss and 4325 oersted respectively.

The advantages obtained according to the invention are best seen by considering the properties of strontium-based ferrite magnets which are commercially available. The best of these has parameters of 3720 gauss and 3075 oersted both of which are inferior to the parameters obtained using the invention. Of course either of the parameters can be improved at the expense of the other, but nevertheless the improvement obtained using strontium phosphate will be apparent. The invention also gives better results than the use of strontium sulphate as described in British Pat. No. 995,374. Using sulphate, the intrinsic coercivity for a remanence of 4160 gauss is 3350 oersted, as compared with 3900 in the example above.

The amount of phosphate which must be added for best results depends on the exact nature of the starting material. The preferred range is 0.4% to 0.6% but amounts up to 3% can be added. An addition of 0.01% can be regarded as a suitable lower limit.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A permanent magnet material consisting essentially of strontium ferrite and from 0.01% to 3% by weight of strontium phosphate.

2. A permanent magnet material as claimed in claim 1 in which the amount of strontium phosphate is from 0.4% to 0.6% by weight.

3. A permanent magnet formed from the material as claimed in claim 1.

References Cited

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TOBIAS E. LEVOW, Primary Examiner

J. COOPER, Assistant Examiner