

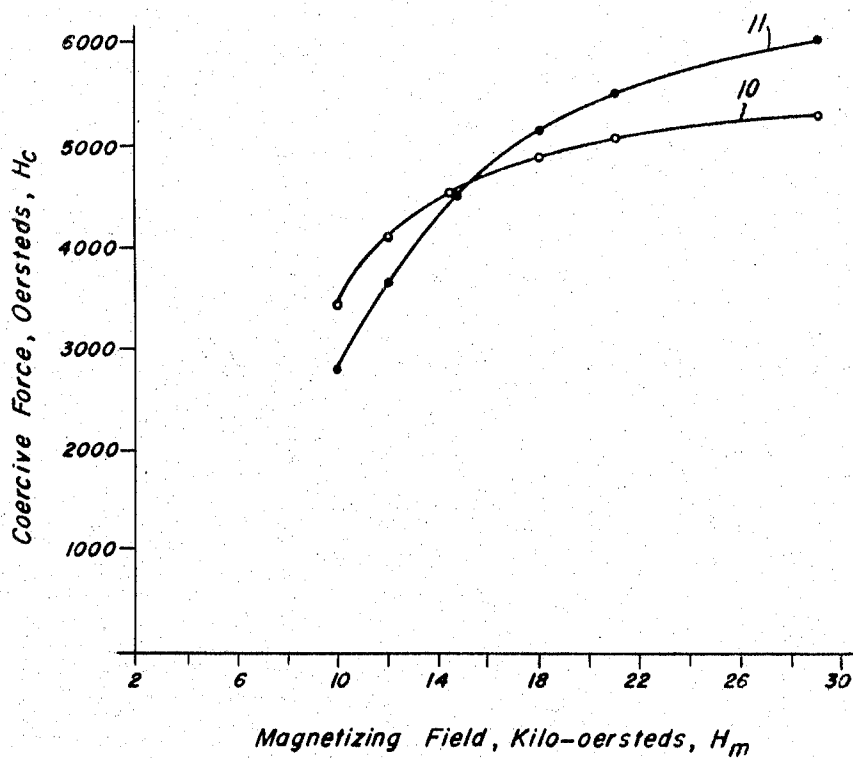
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METHOD FOR IMPROVING MAGNETIC PROPERTIES OF COBALT-YTTRIUM
OR COBALT-RARE EARTH METAL COMPOUNDS

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METHOD FOR IMPROVING MAGNETIC PROPERTIES OF COBALT-YTTRIUM OR COBALT-RARE EARTH METAL COMPOUNDS**Joseph J. Becker, Schenectady, N.Y., assignor to General Electric Company, a corporation of New York**

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2 Claims

This invention relates to magnetic materials and more particularly to a method for improving the magnetic properties of cobalt-base alloys possessing magnetic anisotropy.

Magnetic materials have many and diverse applications in widespread technological areas while in many situations, magnets of uniform strength and nondirectionality are useful; in others, highly directional magnets are to be desired. It is with the latter class of magnetic materials that the present invention is most directly concerned, that is, those magnetic materials exhibiting a definite magnetic anisotropy. It is a principal object of this invention to provide a process whereby the magnetic properties of cobalt-base magnetic materials can be significantly improved. Other objects and advantages of this invention will be in part obvious and in part explained by reference to the accompanying specification and drawing.

In the drawing, the figure shows the difference in the magnetic coercive force of materials produced according to the prior art and of materials of the same composition processed according to the present invention.

Generally, the present invention concerns a process for improving the magnetic properties of the magnetically anisotropic compositions represented by the formula Co_5R , where R represents yttrium, thorium, a rare earth metal or combinations of these materials. The process comprises comminuting the basic alloy at a reduced temperature generally lower than -125°C . and preferably cooled to at least as low as about the temperature of liquid nitrogen, viz -196°C .

Turning to the invention in more detail, the alloys most directly concerned, as previously stated, are those represented by the formula Co_5R . R in this formula represents either yttrium, thorium or one of the rare earth metals occupying numbers 57 through 71 of the Periodic Table of Elements. Additionally, combinations of yttrium or thorium with each other or with the rare earth elements can be used or a plurality of the rare earth metals may be combined to constitute the R portion of the general formula. For example, compounds such as Co_5Y , Co_5Nd , $\text{Co}_5\text{Gd}_{0.3}\text{Nd}_{0.7}$, Co_5Sm are representative of the various types of alloys which can be improved by means of this process.

The ferromagnetic powders are prepared by combining the proper proportions of the selected metals and melting them to form an alloy having the general formula Co_5R . Once an ingot has been obtained, it is comminuted to particulate form, the grinding or comminuting operation being conducted at a temperature no higher than about -125°C . A preferred and expedient way for obtaining the low temperature during the comminuting operation is to effect the operation in liquid nitrogen. Once the comminuting is complete, the particulate material is recovered and is then suitable for use.

Considering some examples, the improvement obtained by effecting the comminution at substantially below room temperature rather than at the normal ambient temperatures is clearly demonstrated by the following data. An

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alloy having the composition Co_5Y was divided into two sample quantities, one of the samples then being mortar-ground for one minute at room temperature and the other of the two samples similarly ground for the same length of time in liquid nitrogen. Both specimens were then measured in an applied magnetic field of 21,000 oersteds to determine their respective coercive forces and it was found that the H_c for the specimen ground at room temperature was 735 oersteds, whereas the H_c for the specimen mortar-ground in liquid nitrogen was 1110 oersteds. Thus, an increase of between 65 to 70 percent in the coercive force was obtained by performing the comminution of the basic alloy at the reduced temperature.

Turning to the curve of the drawing, numeral 10 indicates the properties obtained when measuring the coercive force of the alloy Co_5Sm in fields of varying magnitude when the alloy had been prepared by comminuting to particulate form at room temperature. It can be seen that in an applied field of slightly less than 30 kilo-oersteds that the coercive force was 5300 oersteds. For a quantity of the same material ground to the same particle size of less than about 25 microns but which was comminuted in liquid nitrogen rather than at room temperature, a coercive force of about 6000 oersteds was obtained.

From the preceding results, it can be seen that the coercive force of alloys of the cobalt-base type can be significantly improved in high field strengths by comminuting the basic alloy at reduced rather than at room temperatures.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, I state that the subject matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the specifically described embodiments of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In the process for producing particulate magnetic material having improved magnetic properties, the steps comprising providing a quantity of an alloy having a composition according to the formula Co_5R where R is selected from the group consisting of yttrium, thorium, the rare earth metals, and combinations of these metals with each other, cooling the alloy to a temperature no higher than about -125°C . and comminuting the alloy to the desired particle size while at the lowered temperature.

2. A process as defined in claim 1 wherein the comminution is effected in liquid nitrogen.

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