

1

3,115,461
PROCESS FOR THE TREATMENT OF
FERRITE SLUGS

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1 Claim. (Cl. 252-62.5)

This invention relates to ferrite materials and in particular to an improved process for combining ferrite particles into a slug that may be readily machined with conventional metal working equipment.

An object of the invention is to incorporate an additional step into the usual process of preparing ferrite materials for use in ferromagnetic microwave devices to render the ferrite machinable on standard metal working machines. By providing machinability to a material which under normal circumstances is fired to a hardened state wherein machining may only be done by grinding, the need for molding the ferrite material to the final desired shape is eliminated. In short runs, this is particularly desirable in order to save the expense of making a mold. Furthermore in many instances, the geometry of the ferrite may be such as to render it practically un moldable.

It is to be understood that the term "ferrite" in the specification and claim designates ferros spinels for the use in electrical or electronic devices. These ferros spinels generally have ferromagnetic properties.

In the practice of the invention, ferrite powder is ball milled with water and a binder emulsion into a homogeneous mixture of the desired density, filtered and dried. The mixture may now be pressed under high pressure in a conventional hydraulic press into a slug of compacted ferrite material, which due to the binder will maintain substantial rigidity and may be placed in an oven for treatment under substantially the following times and temperatures in sequence.

Temperature, ° F.:	Time, hours
200	2
300	2
400	2
500	1½
600	1½
700	1
800	1
900	1
1,000	½
2,000	6

which will burn off the binder and transform the ferrite slug into a "green state" or bisque state so that it is capable of withstanding drilling, grinding, reaming, turning, etc. without the use of special machines or tools. Prior to machining, the ferrite slug is oven cooled to 500° F. and thereafter removed and brought to room temperature in air. Once the desired final size and shape is obtained, the ferrite may be fired, as in the prior art, to completely burn off the binder and fuse the ferrite particles together. As is well known, in this latter state, the ferrite is of extreme hardness and is totally unmachinable without recourse to special techniques.

It has been found, for instance, that the expected

2

shrinkage is 4 to 6% on each dimension during the heating thereof, but that this shrinkage may be readily compensated for with the proper selection of the original dimensions. Since the ferrite in the "green state" will absorb some water, it should be dried in a 220° F. oven for 1 hours before final firing. Subsequent final firing produces no important dimensional changes in the ferrite configuration.

Thus, it can be seen how the present invention has added an additional intermediate heat treatment which will transform the pressed ferrite powder into a machinable state, while not causing the prior art glass like hardness to develop. After machining, the final firing may be accomplished to stabilize the entire ferromagnetic device into the desired final hard state. The invention thereby allows the desired shape to be formed by conventional metal working methods which are particularly desirable when a small number of items of the particular shape are required. The prior art, due to the extreme hardness resulting from the single firing therein, required the pressing of the ferrite powder and binder composition into a mold of the desired shape.

Although the invention has specified a sequence of temperatures from 200° F. to 2,000° F., it should be realized that these temperatures and times may be varied depending upon requirements.

We have described what we believe to be the best embodiment of our invention but do not wish however to be confined to the specific embodiment described but what we desire to cover by Letters Patent is set forth in the appended claim.

We claim:

The process of making a ferromagnetic material comprising the steps of, pulverizing ferrite into powder form, mixing a binder therewith, compacting the ferrite in a press into a self supporting slug, heating the slug in an oven for substantially the following sequence of temperatures and periods:

Temperature, ° F.:	Time, hours
200	2
300	2
400	2
500	1½
600	1½
700	1
800	1
900	1
1000	½
2,000	6

cooling the slug in an oven to approximately 500° F. and removing the slug from the last mentioned oven and air cooling to room temperature, and machining said slug to any desired shape with conventional machine tools, and firing said slug to complete the fusion process and attain the final hardness and grain size.

References Cited in the file of this patent

UNITED STATES PATENTS

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