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A novel approach for Plastic Bonded Magnets of the type MQU-F melt spun NdFeGaB –type alloys

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Abstract:

Two routes are used to make bonded magnets: Injection molded magnets can be formed into complex shapes and be insert molded directly onto other components to produce assembly parts, and Compression bonded magnets offer higher magnetic output than injection-molded magnets, but are limited to more simple geometries. The densities obtained with the former technique are in the range of 55-65 % of the theoretical magnetic density and for the second technique can reach up to 75 % and in special cases 78 %. These densities are much less of the one's achieved for sintered magnets , which approach 99 %, resulting to energy products $(BH)_{max}$ of the 50-60 % of the theoretical density of the used powder.

In order to increase the energy density in bonded magnets we introduce a novel technique we termed "plastic sintering", an approach that simulates the classical sintering of magnetic powders of NdFeB.

We have employed a magnetic powder provided by Molycorp of the type MQU-F and as plastic binder MMA. We have coated a distribution of micron sized particles with a very thin < 1 micrometer with MMA, dried and then subjected to compression up to 1.5 GPa. To polymerize the compressed powders we used a conventional furnace and a microwave furnace at around the polymerization temperature of 85 ^{c}C , for the conventional furnace for a period of 3 hours and for the microwave furnace for 10-15 minutes.

We observed that:

- It is possible to plastic sinter MQU-F powders with a density in excess of 80 %
- Sintering time is at least ten times faster with microwaves compared to the conventional way. Care must be taken not to overheat the alloy, because it decomposes
- This approach is very promising for the formation of strong plastic bonded magnets with an energy product higher than the commercial ones

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