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Effect of Warm Compaction on the Microstructures and Magnetic Properties of Iron Powder Core

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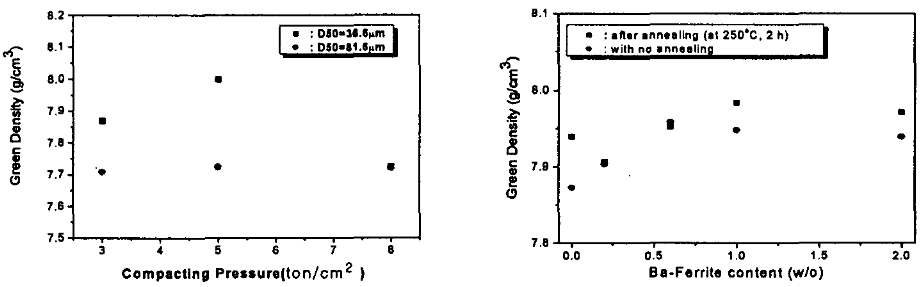
The effect of prcessing variables and methods of commercial iron powder were investigated on the density, microstructure and magnetic properties. The iron powder core was prepared by warm compaction and addition of small amount of ceramic additives. The densification process was investigated with granular microstructure of green body of those compacted samples. The magnetic ceramic powders with quite different particle shape and size were also added to compact the iron powder to change the magnetic loss with frequency. This was sufficient to affect the density and magnetic properties of pressed samples.

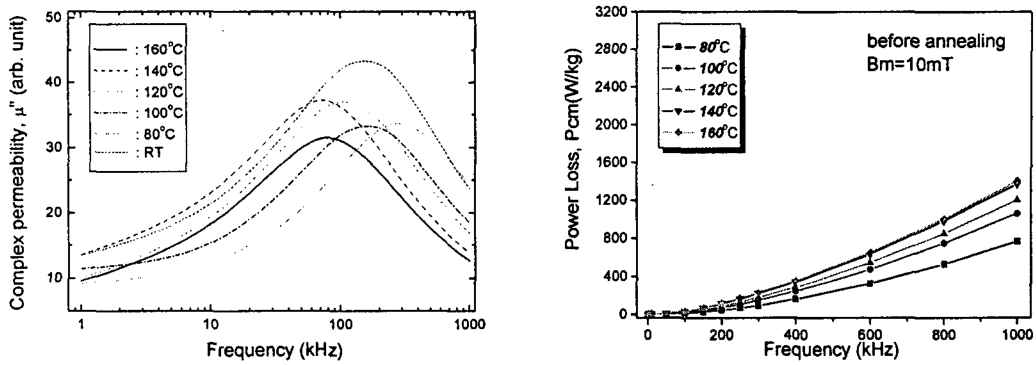
The distinct advantage of the powder is that it can be pressed to a net shape with tight tolerances. During the pressing process, the iron grains are strain hardened, which shows a drop in performance on the magnetic properties[1]. These can be enhanced by warm compaction or annealing. The object of this study was to investigate the effects of those processing parameters on the properties of iron powder core.

As compacting temperature increases for samples before annealing, power loss reveals a relatively small change with frequency. Higher densification was obtained at higher compaction temperature and magnetic property was also enhanced with addition of hexagonal ferrite. The tendency for the lubricant to compact the iron powder core was observed in some tiny range of application when green density was increased with content. However, the higher amount of lubricant seems to be expelled towards the edges of the compact was shown to be more related to the higher mechanical behavior of the powder mix and the smaller porosity in the compact rather than to the higher fluidity of the lubricant at 140~160℃. The variation of magnetic core loss was mainly dependent on the compacting temperature.

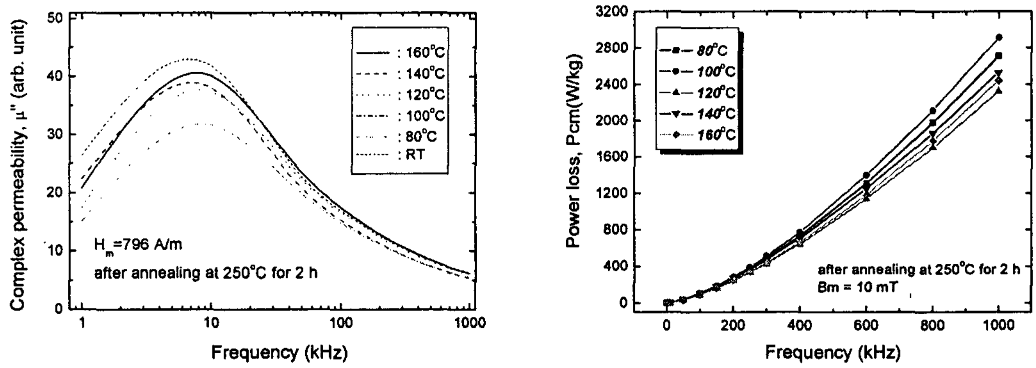


(a) (b)

Fig. 1. Variation of green density of Fe cores ; (a) with compacting pressure formed from those two different average particle size, 36.6 μm and 81.6 μm, respectively, (b) with addition of Ba-ferrite powder resulted from annealing effect.



(a)



(b)

Fig. 2. Magnetic properties of iron powder cores pressed by warm compaction process ; (a) before annealing, (b) after annealing at 250℃ for 2 h in air.