

§20. Study of the Microwave Sintering Applied to the Metal Powder Compacting Body and Investigation into the Penetration Mechanism of the Electromagnetic Field in It

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Using the multi-mode microwave oven (2.45GHz, Max. 3.2kW) the green compact of the iron powder heating is examined. Two types of the samples were prepared. Figure 1 shows two samples. Both samples have same size green compact of the iron powder. The differences between Sample A and B are their heights, and the quantities of the surroundings (the green compact of iron oxide).

Heating experiment was done by each sample. The position of each sample in MW oven was adjusted to the same location. The sample temperature was measured by IR thermometer. In Fig.2 the black dotted circles indicate the region of interest by this IR thermometer. In Fig.2 the cores of two samples (green compact by iron powder) were heated by MW. The initial phase of MW heating the hotter region colored by red was appeared at near top region (Magnetite region) in sample A. On the other hand, the hotter region colored by red was appeared at the center region (Iron region) in sample B. The maximum temperatures of two samples were ~800C and ~900C, respectively.

This result indicates that the heating efficiency of iron green compact by MW may change due to the surroundings of the green compact of iron oxide. The one possibility of this reason is the refraction of MW through the green compact of iron oxide, because iron oxide is dielectric and magnetic.

Figure 3 shows the photograph of the bottom of two samples after MW heating. There is the ring shape shadow in the bottom of Sample B. This may indicate the hotter region during heating was generated by MW concentration. To investigate these phenomena the behavior of MW in oven will be calculated by JMAG (Commercial program code). The important thing is to use the characteristics of the materials. Iron powder in air is surrounded by iron

oxide and it is not uniform. In general MW can penetrate more than its skin depth. To get the characteristics of the green compact of the iron powder is more difficult, therefore, at first only the green powder of iron oxide is used for this simulation.

Also, the heating experiment using single mode MW oven is planned, and the application of MW heating technique will be developed.

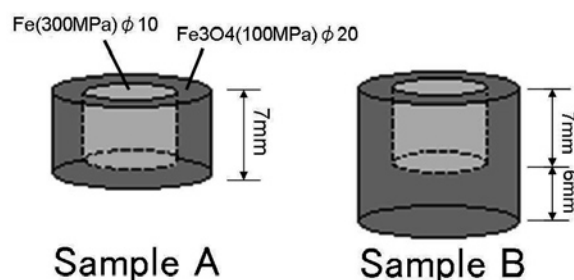


Fig.1 Dimensions of two samples A and B

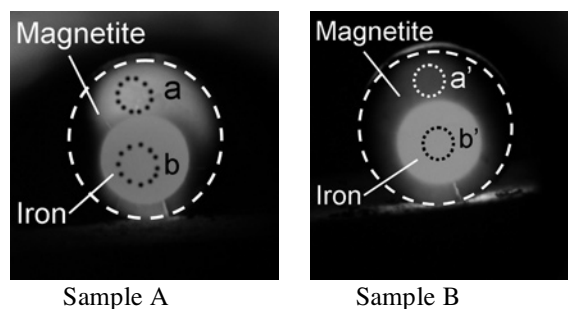


Fig. 2 Photograph of two samples during MW heating

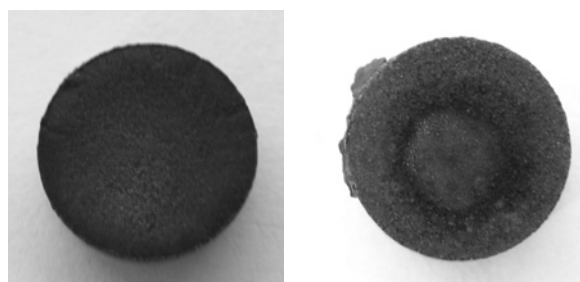


Fig.3 Bottom of two samples after MW heating