Effects of machining on the magnetic properties of sintered NdFeB magnets

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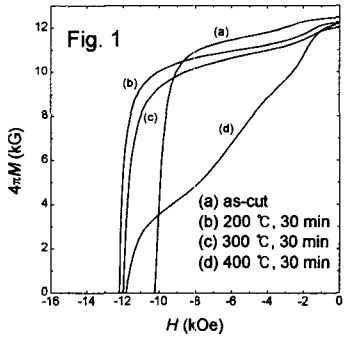
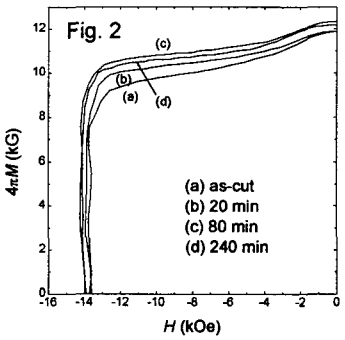
NdFeB sintered magnets based on the $Nd_2Fe_{14}B$ phase show excellent hard magnetic properties, and it is possible to miniaturize electric devices. These magnets of small sizes are produced by mechanical machining and grinding. However, small magnets obtained by machining have some problems of kink at low demagnetizing field in the hysteresis curve, and results in the deterioration of magnetic properties compared with those before machining [1-2]. In this work, we investigated the effects of machining on the magnetic properties of Nd-Fe-B sintered magnets.

The commercial NdFeB block magnet with magnetic properties of B_r = 13.2 kG, ${}_iH_c$ = 12.2 kOe was cut out with dimensions 2 ㎜ in diameter and 2 ㎜ in length using a spark wire machine. After machining the decrement of B_r and ${}_iH_c$ were 0.8 kG and 2 kOe, respectively. After heat treatments at 200 ℃ and 300 ℃ for 30 min, the ${}_iH_c$ was recovered, but the B_r slightly decreased (Fig. 1). Fig. 2 shows the change of coercivity and kink for the chemically etched (nital 10 % solution) specimens after machining using diamond abrasive cutter. The dimensions of the as-cut in Fig. 2 are 1.37 × 1.65 × 1.75 ㎜. The squareness of demagnetizing curve increased with the increase of etching time and showed the optimum (Fig. 2(c)) after the material decrement of 60 volumic percentage of the as-cut.





References

[1] Y. Otani, H. Miyajima, S. Chikazumi, IEEE Trans. Magn. Mag-23, 2527(1987).
[2] H, Nishio, H. Yamamoto, M. Nagakura, M. Uehara, IEEE Trans. Magn. 26(1), 257(1990).