Magnetic flux invasion in HTS bulk magnets with varying the shapes of remaining flux distributions in multiple-PFM processes

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Background

Aim: Application of strong magnetic fields to practical industries

Results

1. PFM in various pre-shaped magnetic flux distributions

• The final flux trapping was insufficient when we took the concave distribution
• The steep/fine conical distributions were obtained when we formed the trapezoid shapes.
• The pre-shaped flux distribution is found to affect the final trapped field distribution.

2. PFM in various M-shaped flux trapping

• In Dy system, the flux invades sluggish and late on its periphery
• The existent magnetic flux apparently restricts the flux invasion
• In Gd system, M-shape flux promoted the invasion in 5-7T application, and lowered the trapped fields
• In the 5-5-7T, promotion of flux invasion and restriction of heat generation resulted in the substantial flux trapping on its periphery.

Various flux distributions correspond to the respective pre-activated M-shape at the centre
• The highest trapped flux of 3.43 T was obtained when the 5-5-7T fields application
• In Dy, the slight excess speed for 5-7 application might result in the higher heat generation
• In Gd, the direct temperature measurement would confirm the result

Summary

• We precisely investigated the effects of applied magnetic flux invasion to the pre-activated samples of Dy and Gd123 systems having various M-shaped flux distributions.
• The bulk magnets trap the substantial remnant flux on the periphery areas of the samples, and the distributions relax the field gradient when the successive pulsed field was applied.
• This phenomenon is capable of suppress the flux motion and heat generation.
• The final flux invasion tends to be promoted when the steep M-shaped distribution is formed.
• When we form the centre area with weak magnetic flux density, the successive applied flux invades toward the centre portion without any blocking by the pre-activated remnant magnetic flux.

Acknowledgment

The bulk sample was supplied by Dr. Teshima in Nippon Steel and Sumitomo Metal Co. The authors give him great thanks for the courtesy.

References


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