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A numerical evaluation of magnetizing characteristic of bulk magnet excited by pulsed-field magnetization with different shaped soft-iron yokes

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A REBCO bulk magnet can make a higher magnetic field than the existing permanent magnets and electromagnets. Recently, various applications of the bulk magnet, such as a compact NMR/MRI system, a magnetic separation system, a generator for a large-scale wind turbine, an electric motor for a ship propulsion system, an aircraft electric population system, and so on, have been developed and considered. In the application to an aircraft electric motor, for instance, the power density, which is an electrical output per unit weight, is a significant parameter. That is, a minimization of the size and weight is required. When applying the bulk magnet to the motor and generator, its magnetization is an important problem. Then, the bulk as a field magnet is activated by the iron-cored field winding as an armature. Although an increase in the size of the soft-iron yoke leads to an increase in the magnetic field, the total weight of the system is also increased, and thus, the power density is decreased. Furthermore, a magnetization method is limited to pulsed field magnetization (PFM) due to a structural restriction in which a bulk must be cooled continuously and must be excited on-site. We study to improve a trapped field of REBCO bulk activated by PFM. The soft-iron yoke is used to expose the sample to a large amount of magnetic flux for a long time. We paid attention to the yoke and investigated the influence of its size and shape on the magnetizing characteristics. In our previous study, we estimated trapped-field performance when using disk-, ring-, and cross-shaped yokes experimentally. This paper investigates numerically the magnetizing characteristics when REBCO is magnetized by PFM with different shaped yokes.

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