Contribution ID: **15** Type: **Oral**

Hybrid superconducting screens combining disk-shaped bulks and closed-loop coated conductors: modelling and experimental validation

Wednesday 12 June 2024 15:40 (20 minutes)

In this communication, we demonstrate numerically and experimentally the remarkable DC magnetic screening ability of hybrid superconducting screens combining a 30 mm-diameter disk-shaped superconducting bulk with different closed superconducting loops made from coated conductors. The loops are placed coaxially with the bulk. The axial, DC and inhomogeneous field to be screened is produced by an air coil. This configuration is studied using a 2D axisymmetric finite element model solved by the H-phi formulation. The measurements are then performed at 77 K using a bespoke, cryogenic 3-axis Hall probe. The results show that such a hybrid superconducting screen allows the maximum shielding factor SF above the bulk to be roughly doubled. In addition, the area of the spatial region for which SF > 2 is multiplied by a factor ˜ 4 when compared to a situation involving only a disk-shaped bulk. The finite element model is also used to investigate the influence of the inhomogeneity of the applied field on the screening effect.

Topic

Applications in large instruments such as high-field magnets, medical magnets and accelerator magnets

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Session Classification: Session 3: Applications