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Real-time Field Mapping of Screening Current induced Fields in an HTS Pancake Coil using a Hall Sensor Array

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Korea Medical Device Development Fund (KMDF) launched a national project to develop a high-temperature superconductor magnet for magnetic resonance imaging (MRI) in 2020. This project's ultimate target is to develop a 6 T 320 mm high temperature superconductor (HTS) magnet. Major concerns in developing the MRI magnet in terms of electromagnetic dynamics are the time-varying field uniformity due to screening current-induced field (SCF) and turn-to-turn leak current relaxation and the consequent temporal field instability in a target diameter spherical volume (DSV) space. Unfortunately, few studies have been conducted to investigate real-time SCF relaxation and the consequent spatial and temporal magnetic field variation with a real-time monitoring approach. Thus, this paper provides real-time monitoring results using a Hall sensor array to investigate the spatial and temporal magnetic field variation induced by SCF in a no-insulation (NI) HTS test coil. Design, fabrication, and operation of an NI HTS test coil were performed. A Hall sensor array was attached to the test coil surface to measure the axial magnetic field's temporal variation and the consequent harmonic coefficient. Calculation with a finite element method (FEM) based simulation model is conducted to compare results with measurements. We provide discussions that include comparison results between calculation and measurement.

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