INVITED

Introduction to Screening Current Induced Magnetic Field in a Double-pancake HTS Magnet

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This research deals with a screening current induced magnetic field (SCF) in a high temperature superconductor (HTS) insert that constitutes a low-/high-temperature superconductor (LTS/HTS) NMR magnet. In this experiment, the HTS insert, a stack of 50 double-pancake coils, each wound with Bi2223 tape, was operated in at 77 K. We investigated the axial magnetic field profile of an SCF in an HTS insert, each induced by one of the following modes of magnetic field excitation: 1) a self field induction of the HTS insert itself; 2) an external field induction; and 3) combinations of both 1) and 2). For each field excitation, which induced an SCF, its axial field distribution and temporal variations were measured and discussed. In an LTS/HTS NMR magnet, not only the magnitude of SCF but also its harmonic gradients—spatial variation—need to be taken into consideration in the magnet design and operation. It has been found, through measurement, that the magnitude of SCF decreases logarithmically with time, whereas its Z1 gradient at and near the mid-plane remains nearly constant with time. Since the temporal field decay of an SCF is likely related to the phenomenon of flux creep, the field decay rate could depend on operating temperature and magnetic field. To estimate the elapse time for an SCF to "settle" so that field mapping, may be performed, needed to apply shimming, a correlation among temperature, magnetic field, and SCF decay rate should be investigated.

Keywords : Double-pancake, HTS insert, nuclear magnetic resonance (NMR), screening current induced field (SCF).