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Diffusion process of screening current in REBCO coil wound with copper-plated muti-filamentary REBCO tape

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High-field magnets wound with REBCO tape and their application to NMR have undergone considerable research and development. NMR coil systems require a highly accurate field; i.e. homogeneous and temporally stable field. However, in case of REBCO coils, the screening current induced magnetic field spatially and temporally deteriorates the field quality.. The filamentization of REBCO tape enables us to reduce the screening current induced magnetic field in REBCO tape coils. The multi-filamentary REBCO tape is usually plated with copper for mechanical strength and thermal stability. In this case, the coupling currents are induced between filaments in REBCO tape during changing the magnetic field. Therefore, the screening current passes through the filaments with a characteristic length and flows along the winding tape. Therefore, the behavior and diffusion process of screening current depend on the geometry of the coil winding and the effective transverse resistivity between filaments in REBCO tape. In our previous study, we have developed the numerical simulation code to calculate the spatial and temporal behavior of screening current distribution in REBCO coil. This simulation code is taking into account the three-dimensional geometry treatment of the coil winding and the electromagnetic interaction among tapes. In this study, we numerically investigate the diffusion process of screening current for a layer wound REBCO coil and a double pancake; both coils are wound REBCO coil with copper-plated multi-filamentary REBCO tape. The numerical simulation result was compared with the experimental result presented elsewhere [1]. We will discuss on the current distribution in REBCO tape, the characteristic length of coupling current and time constant of magnetic field diffusion.
[1] T. Ueno et .al. “The coupling time constant for a multi-filamentary REBCO coated-conductor solenoid”, Applied Superconductivity Conference 2016, 3LPo1L-05.

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