



Contribution ID: 749 Contribution code: WED-PO2-709-05

Type: Poster

Long-Term Operation Results of a Stack of Metal Insulation HTS Pancake Coils for SMES Applications

Wednesday, November 17, 2021 10:30 AM (20 minutes)

As the so-called no-insulation (NI) HTS winding technique or its variations have expanded their applications beyond laboratory magnets, technical concerns on lifecycle such as lifetime, fatigue, long-term performance variation have become an important and timely imperative issue for the actual application of an HTS magnet to real-world systems. This paper reports long-term time-varying operation results of a metal-insulation (MI) HTS magnet with a focus on temporal variation of key coil parameters. Specifically, to ensure temporal stability of the magnet, it is necessary to track changes in key parameters such as critical current or surface contact resistivity. The NI HTS magnet consists of a stack of double-pancake coils wound with REBCO tapes, and operates in a bath of liquid nitrogen at 77 K and/or under a conduction-cooling environment at temperatures ranging 20–77 K. The experimental results are analyzed using our in-house simulation tools including lumped circuit analysis, partial element equivalent circuit (PEEC) analysis and/or finite element analysis.

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018R1A2B3009249). This work was also supported by Samsung Research Funding & Incubation Center of Samsung Electronics under Project Number SRFC-IT1801-09.

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Session Classification: WED-PO2-709 No-Insulation Coils