Contribution ID: **272** Type: **Poster**

Thu-Mo-Po.04-01: Experimental study on overcurrent and quench characteristics of NI HTS coil wound with thin REBCO tape

Thursday 3 July 2025 08:45 (2 hours)

For non-insulated (NI) HTS coils wound with thin REBCO tapes, on the one hand, due to increasing current density, the coils can generate higher magnetic field; on the other hand, the compactness and the mechanical stability of the coils can be improved for the reason of higher proportion of Hastelloy. However, up to now, there is a lack of experimental research data on the electro-thermal stability of such NI coils. This work builds an experimental test platform for these NI coils, focusing on the coil electro-thermal stability. Our experimental coil is wound with 50μm thick REBCO tape (10μm for the single-sided copper layer and 30μm for the Hastelloy layer) using NI technology. It is worth noting that the experimental coil has more than 200 turns, more than 8 temperature sensors, and more than 10 voltage testing signals, which helps us realistically simulate the coils used for high-field superconducting magnets and fully understand its electrical and thermal characteristics during overcurrent and quench events. In addition, for the first time, we put both local heater and whole-turn heater into the coil. Using the former one to trigger quench events can obtain the circumferential normal zone propagation velocity (NZPV) of the coil, and using the latter one can obtain the radial NZPV, which helps us to decouple heat transfer at circular direction and at radial direction. In order to make the power supply produce higher heating power, we divide the whole-turn heater into 4 parts and connect them in parallel, thereby improving the matching degree between the resistance of the heater and the rated resistance of the power supply. The experiment was carried out under the conduction-cooled condition. At 77K, 65K and 20K, we firstly tested the critical current of the coil as a benchmark for subsequent experiments. We then set the coil current to 1.3Ic to test the coil ability to cope with overcurrent. Finally, we set the coil current to 0.7Ic, using local heater and whole-turn heater to trigger the quench, and evaluated the minimum quench energy (MQE) and NZPV of the coil. This work further improved the database of electro-thermal stability performance of NI coils, providing important data support for magnet design, construction, analysis and modeling.

Author: Mr ZENG, Hongzhuo (Institute of Electrical Engineering, Chinese Academy of Sciences)

Co-authors: Prof. ZHANG, Zili (Institute of Electrical Engineering, Chinese Academy of Sciences); Prof. CHEN, Shunzhong (Institute of Electrical Engineering, Chinese Academy of Sciences); Mr CHEN, Yong (Institute of Electrical Engineering, Chinese Academy of Sciences); Dr ZHOU, Benzhe (Institute of Electrical Engineering, Chinese Academy of Sciences); Mr JI, Xiaoyu (Institute of Electrical Engineering, Chinese Academy of Sciences); Prof. QI, Lei (North China Electric Power University); Prof. WANG, Qiuliang (Institute of Electrical Engineering, Chinese Academy of Sciences); Prof. LIU, Jianhua (North China Electric Power University)

Presenter: Mr ZENG, Hongzhuo (Institute of Electrical Engineering, Chinese Academy of Sciences)

Session Classification: Thu-Mo-Po.04 - No-Insulation Coils III