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A Study on Post-Quench Behaviors of No-insulation HTS Magnet under Over-Current Conditions

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Recent studies on no-insulation (NI) winding techniques for high temperature superconducting (HTS) coils have demonstrated that an NI coil has a self-protecting feature: a localized quench heat inside the coil can be automatically diverted in the radial direction owing to the absence of turn-to-turn contacts. The obvious benefits of NI may resolve difficulties in the protection of the HTS coil, which is highly vulnerable to the quench. However, prior to applying the NI technique to the full-scale magnet including several double pancake (DP) coils, it is essential to examine the availability of the self-protecting features between the “axially connected DP coils” as well as between the turn-to-turn contacts in each DP coil. In this study, post-quench behaviors of an HTS magnet including four GdBCO DP coils were investigated through over-current tests. The purpose of the over-current tests was to intentionally quench the HTS magnet, thereby subjecting it to severe operating conditions, and then examine the thermal, electrical, and magnetic integrities of the magnet, validating the intactness of its axial self-protecting feature.

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Submitters Country

Republic of Korea

Primary authors: Mr CHOI, Yoon Hyuck (Department of Materials Science and Engineering, Korea University); Prof. LEE, Haigun (Department of Materials Science and Engineering, Korea University)

Co-authors: Dr SONG, Jung-Bin (Department of Materials Science and Engineering, Korea University); Mr KIM, Young-Gyun (Department of Materials Science and Engineering, Korea University); Ms SON, Hyun Hee (Department of Materials Science and Engineering, Korea University); Dr CHOI, Yeon Suk (Korea Basic Science Institute); Mr KIM, Junseong (Electrical and Electronic Engineering, Yonsei University); Prof. KO, Tae Kuk (Electrical and Electronic Engineering, Yonsei University)

Presenter: Mr CHOI, Yoon Hyuck (Department of Materials Science and Engineering, Korea University)

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