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Tue-Af-Po2.14-07 [7]: Over-current test on an intra-layer no-insulation (LNI) REBCO coil under a high background field

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The no-insulation (NI) method has provided dramatic progress on the high-field magnet technology in the last decade. An NI REBCO pancake coil can operate at a very high current density supported by a self-protecting behavior. However, it was recently demonstrated that asymmetric distributions of axial forces due to electromagnetic forces during the quench propagation results in serious mechanical damage on the NI REBCO pancake coil [1]. In the case of an NI REBCO layer-wound coil, whose effectiveness was recently demonstrated by using an “intra-layer no-insulation (LNI)” method, it is possible that the coil does not face such degradations because the axially unbalanced electromagnetic forces are hard to occur in an LNI REBCO coil [2]. However, such a potential advantage has not been experimentally demonstrated and in the present work we will conduct over-current experiments on an LNI REBCO coil in liquid helium in an LTS coil background field.

We wound an LNI REBCO coil with a single piece REBCO conductor of 250 m. For applying the LNI method, one-side insulated copper sheets were inserted between all the layers. The coil winding was 18 mm in inner diameter, 70 mm in outer diameter, 40 mm in height. The number of layers was 160 and the total turns were 1604. The LNI REBCO coil and a Bi-2223 coil were series connected and charged in the cold bore of a 17.2 T LTS magnet until the LNI REBCO coil reached a thermal runaway. The LNI REBCO coil eventually showed a thermal runaway at 289.6 A in the center magnetic field of 31.4 T and the coil was protected.

[1] P. C. Michael et al., Presented at ASC2018, 2LOR1D-01 (2018)

[2] Y. Suetomi et al., Supercond. Sci. Technol. 32 (2019) 045003

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