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Thu-Mo-Po.10-05: Preliminary Quench Analysis on HTS Stacks-In-Conduit Conductors for Fusion Toroidal Field Coils

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Strong magnetic fields might be crucial for enhancing the performance of nuclear fusion devices. High-temperature superconducting (HTS) tapes have emerged as promising materials due to their capability of carrying high current densities in high-magnetic field environments. Alongside with various types of HTS conductors for fusion proposed by numerous research institutions, in our previous studies, we proposed novel non-twisted HTS stacks-in-conduit conductors (SICC). As an extension, a preliminary quench study has been carried out by using a thermal-hydraulic modeling analysis on KSTAR size toroidal field (TF) coils to establish an effective protection scheme. We evaluate the thermal runaway temperature and minimum runaway energy through coupled thermal-hydraulic simulations. As compared with cable-in-conduit conductors (CICC), where cryogen forced-flows due to porous nature of cables, SICC can be characterized by their fast cryogen flow, which enables relatively fast ramping rate for TF charging. Thermal disturbance both during ramping and normal operation conditions are studied. Characteristic difference as compared with CICC will be further discussed.

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