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Demonstration of a Wind and React MgB2 Solenoidal Coil Segment for MRI Applications

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This work is a contribution to the development of the technology for an MgB2 based cryogen-free superconducting magnet for a 3T whole body MRI system. Specifically, we demonstrate that a react and wind coil segment can be made using a high-performance in situ route MgB2 conductor and that the coil could be operated in conduction mode with low levels of temperature gradient. A multifilamentary MgB2 conductor was used for the winding of a sub-size MRI-like coil segment. The wire was twisted, reacted, and then insulated with s-glass. After insulation, the coil was wound on a 0.9-m OD copper former. The total length of the conductor used was 1km. The coil was instrumented for low temperature testing and then epoxy impregnated. Ten sets of voltage taps and ten thermocouples were used, along with two Cernox sensors, quench disturbance and quench protection heaters, strain gauges, and two hall probes (these latter for field measurements). The coil was installed into a large conduction cooled cryobox for cooldown and testing. After the initial cooldown the coil temperature was increased, and Ic was measured as a function of temperature with decreasing temperature. The radial field of the coil was measured on the former (near the winding) and used to compare coil Ic to short sample Ic via a load line plot. The quench disturbance heater was then used to generate a series of progressively larger normal zones, the growth of which was characterized, and is presented. This was done in a progressive way, pushing from small normal zones which recovered to those which did not, allowing us to investigate an active quench protection scheme devised for the coil, and the results are discussed.

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USA

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