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Minimum Quench Energy of NbTi and Nb3Sn Conductors Impregnated with High Heat Capacity Resin

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A major focus of Nb3Sn high field accelerator magnets for HEP is on significantly reducing or eliminating their training. Samples of NbTi and Nb3Sn wires and Rutherford cables were impregnated with organic olefin-based thermosetting dicyclopentadiene (DCP) resin, commercially available as TELENE® by RIMTEC Corporation in Japan, mixed with high heat capacity ceramic powders. The high heat capacity resins in this study were fabricated at NIMS by a combination of a ceramics powder filler and the DCP resin. The DCP resin is typically cured by the use of an additive, which is the ruthenium complex. The curing time is controlled by the amount of retardant. The powder filler is selected among high heat capacity ceramics, such as Gd2O3, Gd2O2S, and other magnetic regenerating compounds. For impregnated wires samples, the Minimum Quench Energy was measured. In addition, a Transverse Pressure Insert (TPI) measurement system was used to characterize training-like behavior in each resin. For impregnated cables, a Rutherford cable test facility with superconducting transformer and spiral bifilar sample for cable tests up to 15 T and 30 kA was used to measure minimum quench energy of epoxy impregnated samples vs. TELENE® impregnated ones.

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