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Tue-Mo-Po2.13-05 [112]: The Superconducting NbTi Wire for the Superconducting Dipole Magnet for CBM Experiment at FAIR

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The superconducting dipole magnet for the Compressed Baryonic Matter (CBM) experiment at FAIR houses the Silicon Tracking System (STS), and provides a magnetic field integral of 1 Tm which is needed to obtain a momentum resolution of Δp/p = 1% for track reconstruction at FAIR beam energies. The magnet gap has a height of 140 cm and a width of 250 cm in order to accommodate the STS with a polar angle acceptance of ± 25° and a horizontal acceptance of ± 30°. The magnet is of the H-type with a warm iron yoke/pole and cylindrical superconducting coils in two separate cryostats.
About 1 tone of the NbTi conductor (wire) size 2.02 mm × 3.25 mm with filament diameter ˜ 40 μm, single piece length 5 km and a Cu/SC ratio of about 7.4 is necessary for the making of superconducting coils.
NbTi conductors (wires) with a high Cu/nonCu ratio and a large cross-sectional area are usually made using the «wire-in-channel» technology. Current-carrying capacity in wires of this type is determined (limited) by the current-carrying capacity of the soldered SC insert. The "wire-in-channel" technology involves using of solders with harmful additives and uneven filament distribution in the copper matrix aggravating heat dissipation.
In this paper, we demonstrate the possibility of successfully producing the NbTi wire of size 2.02 mm × 3.25 mm with a single piece length of 5 km and relative residual resistance (RRR) >200 in the monolithic technology for CBM experiment at FAIR. Critical current exceeds 2270 A (E = 0.1 μV/cm; 5 T; 4,2 K) at the copper/non copper ratio 7.4:1.

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