



Contribution ID: 254

Type: **Poster presentation (105min)**

Preparation of NbTi superconducting wire with a Cu10Ni matrix

In this study, NbTi superconducting wire was prepared with high pure Cu10% Ni alloy as the matrix material using the methods of assembling for three times. The ratio of copper to superconductor was 1.8 and the final size of the wire was 0.7 ± 0.005 mm, with 7225 filaments. Optical microscopy (OM), scanning electron microscopy (FESEM), line energy spectrum analysis (EDS) and transmission electron microscopy (TEM) were observed on its cross-section, microstructure and filament surface. Moreover, a low-temperature test system was used to measure the critical current I_c and n values (@ 4.2 K, 3.0, 4.0, 5.0, 6.0 T) for samples with different aging processes. The residual resistance ratio value (RRR) was also measured. Test results show that the NbTi average filament diameter for the $\Phi 0.7$ mm wire is 4.9 μm . The filament deformation was uniform and the surface was smooth without CuTi compounds. The critical current test results showed that after three aging and eventually wire strain of 4.0 for the $\Phi 0.7$ mm wire at 5 T, the critical current was 286 A (@4.2K,5T) and the critical current density was 2087 A/mm². The n value was about 15.6, while the RRR was 105. The wire had a low hysteresis loss, which was 22 mJ/cm³ (@ 4.2 K, ± 3.0 T).

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