

Characterization of high T_c superconductor tapes and coils under high magnetic field and variable temperature

Summary (400 caractères maxi)

The specific properties of REBCO high temperature superconductor (HTS) tapes able to carry strong electrical currents under high magnetic field at low temperatures offer an exceptional opportunity to go beyond 25 T, the actual limit of conventional low temperature superconductors (LTS). We are currently aiming at the fabrication of an HTS insert, made of pancake coils, for generating at least 10 T at 4.2 K in a background field of 20 T.

Detailed subject (1200 caractères maxi dont une figure possible)

HTS tapes are commercially available in length sufficient for fabricating pancake coils. They are however highly anisotropic and a characterization of their critical current, which is defined as the maximum current they can carry before a transition to the normal state, versus magnetic field strength and orientation at different temperatures is needed for designing model coils and assessing load margins.

In particular, we propose to study promising REBCO coated conductor tapes in the form of short straight samples (2-3 cm) from 77K down to 4K up to 20-30 Tesla at LNCMI. The manufacturers provide only the critical current at 77K in self-field. These data about up-to-date existing materials will be used to address the correlation of critical current measurements and inhomogeneity at 77 and 4K with regards to processing and additional pinning centers.

We then propose to test small pancake coils in order to study their quench behavior and to compare their critical current with the one that can be estimated from the data obtained on straight samples.

Publications linked to the theme

T. Benkel et al., "REBCO performance at high field with low incident REBCO performance at high field with low incident", IEEE Trans. on Appl. Superconductivity 26 (2016) 4302705

F. Borgnolutti et al., "Design Study of a 10-T REBCO Insert Solenoid", IEEE Trans. on Appl. Superconductivity 26 (2016) 4600405

D K Hilton, A V Gavrilin and U P Trociewitz, "Practical fit functions for transport critical current versus field magnitude and angle data from (RE)BCO coated conductors at fixed low temperatures and in high magnetic fields", Supercond. Sci. Technol. 28 (2015) 074002

Background and skills expected

Physics, Material science, Electrical measurements, Vacuum, Cryogenic

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