Critical Current Measurement at 4.2 K up to 15 T of High-Temperature Superconducting Magnet Cables

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Introduction

The next generation of high-field magnets requires operating fields exceeding 20 T and that cannot be reached with low-temperature superconductors, such as NbTi or Nb_3Sn and high-temperature superconductors (HTS), such as $REBa_2Cu_3O_{7-\delta}$ (REBCO) coated conductors, are the only option. We've introduced a new cabling method that enables the construction of very flexible conductor on round core (CORC) cables that meet the requirements for high-field magnets [1,2] and performed cable tests at 4.2 K at magnetic fields up to 20 T at the user facility of the NHMFL.

Experimental

Several REBCO coated conductors cables were constructed using the method as outlined in Ref. [1]. One of the cables was measured at two different cable-bending diameters to test its flexibility. Figure 1a shows the cable wound in a 6-cm diameter loop before testing at 15 T.

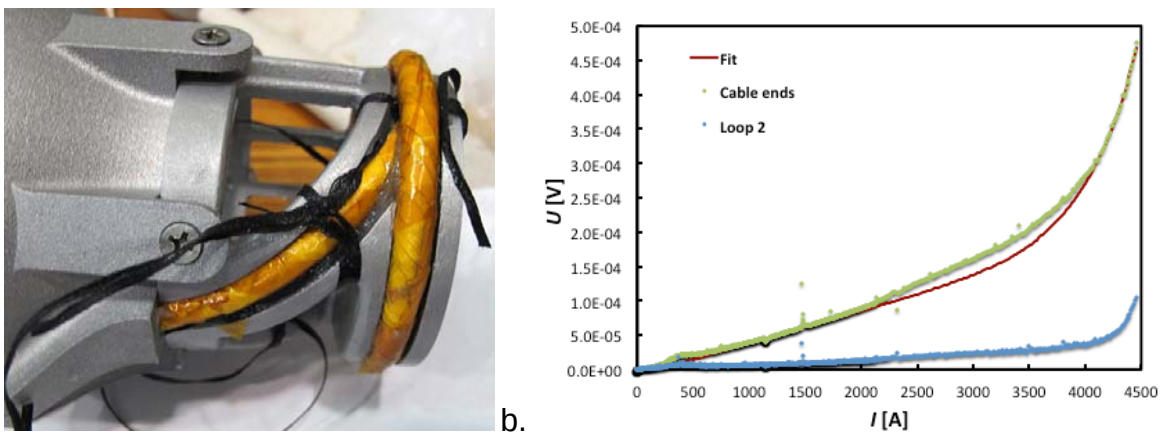

Figure 1. a) CORC cable wound at a diameter of 6 cm. b) Voltage vs. current at 4.2 K the CORC cable at 15 T.

Results and Discussion

The CORC cable shown in Fig. 1a had an I_c of about 4 kA in a total field of 15 T when wound at a diameter of 11 cm and didn't show any degradation when wound into a bending diameter of 6 cm. The superconducting transition is shown in Fig. 1b.

Conclusions

We successfully performed several measurements on CORC cables at a field of 15 T at different bending diameters. The results show the feasibility of CORC cables for accelerator magnets that require a cable-bending diameter of 6 cm.

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References

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[2] van der Laan, D.C., *et al*., Supercond. Sci. Technol. **25**, 014003 (2012).