Continuous Characterization of REBCO Coated Conductors: Comparison of Transport and Magnetization Measurements

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Introduction

REBCO coated conductors (CC) with high remarkably high critical currents are now available commercially. However homogeneity of critical current and defects in long length tapes are still an issue. Thus, to assure the performance of CC, it is crucial to characterize them before applications. There are generally two ways to characterize long CCs: transport and magnetization measurement. Continuous transport measurement of I_c has been developed by Coulter, et al.at LANL. However, the time efficiency of this approach is low. 10 meter long tape usually takes more than 6 hours. In order to improve the speed, remnant field measurement is adopted as an alternative way for characterization. These methods are briefly compared here.

Experimental

The device for characterization in LN_2 has a similar construction as an audio cassette. There are 2 spools, one to feed the tape and the other to take up. Between the 2 spools there are magnets, current leads, voltage taps and a fixed Hall sensor array, which is made up of 7 Hall sensors. The whole device is immersed in LN_2. During magnetization measurements, the CC moves ~ 100 faster than in transport measurement.

Results and discussion

Figure 1 compares results of both methods. It is seen that remnant field (or magnetization) characterization is reliable; its spatial distribution along the conductor corresponds well to the I_c measurement. Moreover, its spatial resolution is much better: 1 mm vs 20 mm in transport method. Indeed, as indicated by arrows, at the beginning of the tape magnetization method reveals several crack-like defects across the tape and only two biggest of them are observed in transport measurement.

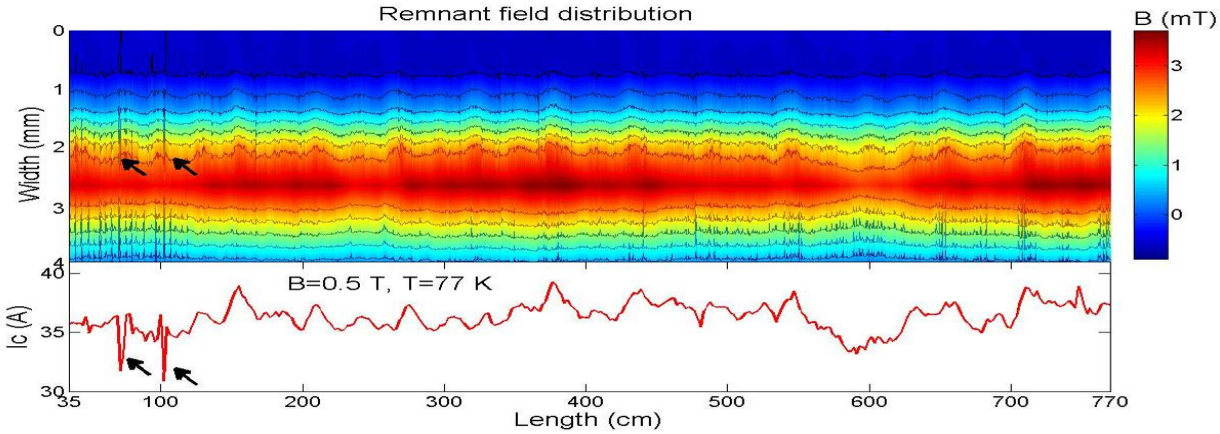

Figure 1. top: remnant field distribution after tape passing through the magnet in LN_2. Bottom: I_c transport measurements in LN_2 of the same ~7m of conductor..

Conclusions

Magnetic characterization with Hall sensors is faster and has better spatial resolution in finding defects. However, it does not measure absolute I_c value as accurate as transport method. Thus, both methods should be used at least at some parts of the conductor.

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References

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