QUENCH BEHAVIOR OF Y-Ba-Cu-O COATED CONDUCTORS

X. Wang (FSU, Electrical Engineering); U.P. Trociewitz (NHMFL); J. Schwartz (NHMFL, Mechanical Engineering)

Introduction

Although the minimum quench energy (MQE) needed to quench a high-temperature superconductor is significantly higher than for low temperature superconductors, the slower normal zone propagation velocity (NZPV) may cause a hotter hot-spot and hence increased possibility of conductor degradation [1-5]. Here we measured the MQE and NZPV for Y-Ba-Cu-O (YBCO) coated conductors. Preliminary damage tests have also been done on an YBCO coated conductors.

Experimental

The YBCO samples are provided by American Superconductors Corporation (AMSC) and IGC SuperPower Inc. (IGC-SPI). The sample length is 25 cm. Samples are conduction cooled by a cryocooler in a quasi-adiabatic environment with a typical vacuum of 10^{-6} mbar. A heat pulse is given by a NiCr wire heater attached to the tape. Voltage and temperature profiles along the sample during the quench are monitored. Quench induced sample degradation is studied through an over-time heating.

Results and Discussion

MQE and NZPV are measured as functions of temperature and transport current. For the same ambient temperature, MQE increases when reducing the transport current. With transport current fixed, MQE increases when the ambient temperature decreases. The highest value of MQE is 3.4 J for a tape with copper stabilizer running 108 A, 30% of I_c at 58 K. The lowest MQE is 0.28 J for a tape without copper stabilization layer running 36 A, 90% of I_c at 70 K. NZPVs are less than 50 mm/s for temperatures ranging from 40 K to 80 K. NZPV decreases when the transport current decreases at the same temperature and increases with increasing temperature when fixing the transport current. For the preliminary degradation test, a heat pulse is applied to initiate the quench and the transport current is kept constant for about 2 s. Severe damage (only 50% of the initial critical current remaining) occurs at those sections with originally lower critical currents. While other sections remain intact, the locally damaged sections cause the overall critical current of the whole tape to be degraded.

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