HIGH FIELD CHARACTERIZATION OF STRANDS FOR SUPERCONDUCTING MAGNETS OVER 21 T

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Introduction

High magnetic field generation for GHz NMR and beyond will require significant superconducting wire improvements. We are studying two high field materials: Nb_3Sn strand made by the internal tin process, and powder-in-tube BSCCO-2212 round wires. From the view point of practical application, Bi-2212 round wires have significant advantages over more typical HTS tape conductors, such as ease of handling and coil winding, allowing considerable flexibility in the magnet design.

Experimental

Samples were measured in the 25 T magnets in either Cell 5 or Cell 6. Samples were measured in liquid helium at 4.2 K, and pumped to 2.2 K and 1.8 K. Nb_3Sn wires were measured on Ti mandrels, BSCCO-2212 wires on stainless steel.

Results, Discussion, and Conclusion

For Nb_3Sn conductors, optimization of Nb/Cu/Sn fractions and heat treatment have greatly improved performance.[1] Our previous work had shown excellent J_E (engineering critical current density) values for larger diameter (1.3-1.5mm) strand, but for the greatest flexibility in magnet design, it is important that the high properties are available across a range of wire sizes.. In 2004, we used DC transport current measurements to study strands from 0.9mm to 1.1mm. Fig.1 shows J_E as a function of wire diameter for Nb_3Sn strand. High J_E values can be achieved across a wide range of wire diameters, provided the heat treatment is appropriate for the wire size.

BSCCO-2212 development efforts in 2004 have been aimed at enhancing transport properties in long lengths of round wires for high field magnet applications. Significant J_c and J_E improvements have been achieved by optimizing the starting powder compositions, fill factor, deformation processes, and the melt-solidification parameters. J_E values of 460 A/mm^2 have been obtained at 4.2 K, 25 T in 0.81 mm wire, as shown in Fig.2. [2]

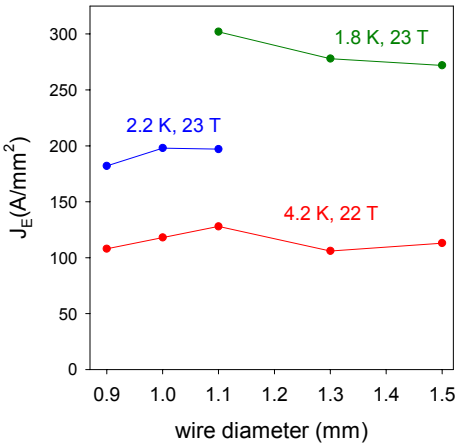

Fig. 1. J_E values as a function of wire diameter, field, and temperature for Nb_3Sn strand.

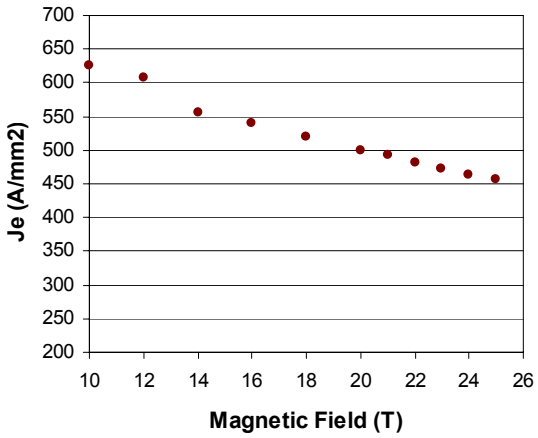

Fig. 2. J_E values as a function of magnetic field for BSCCO-2212 round wire.

References

[1] J.A. Parrell, *et al.*, to appear in *IEEE Trans. Appl. Supercond.* (2004) (ASC'04).
[2] H. Miao, *et al.*, to appear in *IEEE Trans . Appl. Supercond.* (2004) (ASC'04).