MAGNETIC FIELD ENHANCED TEXTURE OF LOW ASPECT RATIO $Bi_2Sr_2CaCu_2O_{8+x}$ AgMg WIRES BY ELECTRICAL TRANSPORT

M.A. Ramos, (FAMU-FSU College of Engineering, NHMFL); U.P. Trociewitz (FSU NHMFL), J. Schwartz (FAMU-FSU College of Engineering, NHMFL)

Introduction

Improved $Bi_2Sr_2CaCu_2O_{8+x}$ (Bi2212) may play a key role in future high field magnets. Previous studies on high aspect ratio Bi2212 tapes by applying a background magnetic field during the partial melt stage have shown significant property improvements [1]. Here we report on texturing of Bi2212/AgMg low aspect ratio multifilamentary wires using a 12 T background magnetic field. To determine if a textured microstructure is produced, in-field processed samples were characterized electrically by measuring the transport critical current versus field angle in applied magnetic fields up to 5 T.

Experimental Approach

Unreacted Bi2212/AgMg low aspect ratio wire consisted of 595 filaments with cross-sectional dimensions of 1.05 mm x 0.68 mm. Samples were heat treated in a vertical furnace installed inside the NHMFL large bore resistive magnet with a 12 T field oriented perpendicular to the wide surface. Magnetic field was applied starting at 10°C below the peak temperature (T_m) and held for 5 h until the temperature reached T_m - 40°C. Critical currents of the samples were measured at 4.2 K using a 1 μV/cm electric field criterion using a probe with a rotating sample holder to allow for measurements at varying field angles.

Results and Discussion

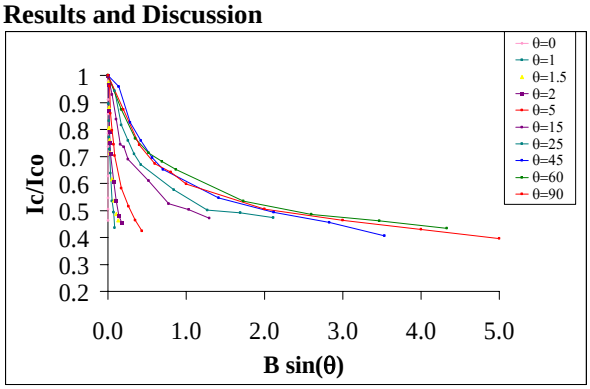

Fig. 1. $I_c/I_{co}(Bsin(\theta))$ curves for a wire heat treated in a 12 T background magnetic field.

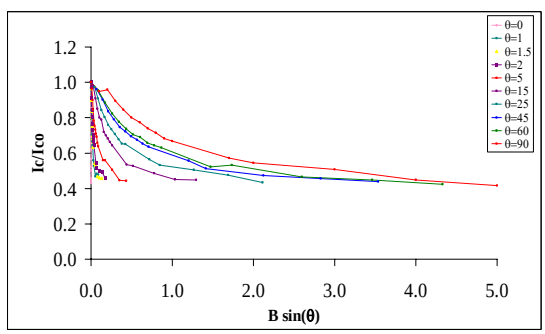

Fig. 2. $I_c/I_{co}(Bsin(\theta))$ curves for a wire heat treated in zero applied field.

I_c/I_{c0} versus the effective applied field $Bsin(\theta)$ curves are shown in figures 1 and 2. In Figure 1, a separation of the curves is seen for samples heat treated at 12 T, which is not observed for samples heat treated without applied field (figure 2). This shows that anisotropy is introduced into the electrical behavior via magnetic field processing, indicating that the magnetic field during heat treatment influences textured grain growth in the grains that subsequently carry the transport current.

Conclusions

Using a 12 T background magnetic field, texture can be induced in low aspect ratio Bi2212/AgMg multifilamentary wires. Samples were characterized by electrical transport at various field angles up to 5 T. For comparison, samples from the same batch of wire were heat treated with and without 12 T applied field under identical conditions. Electrical measurements showed that texture was introduced into the wires via magnetic field processing.

Acknowledgment

The authors thank Oxford Superconducting Technology for Bi2212 samples. This work supported by the NSF through the PREM program.

References

[1] Maeda, H. *et al*., Physica C, 386 115-121 (2003)