Angular Dependence of the Irreversibility Field in Doped REBCO

C. Tarantini, J. Jaroszynski, F. Kametani (NHMFL-FSU, Tallahassee FL); Y.L. Zuev, D.K. Christen (ORNL, Oak Ridge TN)

Introduction

YBCO is a top candidate for high field low T applications with record high critical current and high irreversibility fields. However, there is notorious problem with its high anisotropy, which limits these applications. The purpose of this work is to analysis the angular dependence of the irreversibility field $H_{ir}$ on samples where doping has been introduced or nanoparticles have been added and to correlate it the structural properties.

Experimental

The data reported here show the results on REBCO samples with BZO nanorods. They have been measured by transport both in a 16T-PPMS (Figure 1) and in high magnetic field at the NHMFL (Figure 2) varying temperature. Those data have been compared with microstructural properties analyzed by high resolution TEM shown in the inset of Figure 1.

Results and Discussion

The angular dependences in Figures 1 and 2 show a behavior that differs from the Ginzburg-Landau model, in fact they have an unexpected flatten region between the two ab-peaks. In particular, as emphasized in Figure 1, an extra peak is evident at about 190°. Performing TEM analysis we found that the BZO columns are not perpendicular to the film surface but they are arranged at about 80° from the ab-plans. Figure 2 compares the irreversibility field in a wider range of temperature. A temperature dependence of the anisotropy $\gamma$ is found varying between 3.7 (at 84K) and 5 (at 70K).

Conclusions

The anomalous behavior of the angular dependence has been correlated to the sample microstructure that shows as the BZO columns form strong pinning centers. Moreover the anisotropy temperature dependence reveals that such pinning centers are more effective close to $T_c$, reducing $\gamma$.

Acknowledgements

This work is supported by U.S. DOE Office of Electricity Delivery and Energy Reliability - Superconductivity Program for Electric Power Systems Advanced Cables and Conductors

References