In Field Low Temperature Laser Scanning Study of Artificial Defects on IBAD YBCO Coated Conductor

Pei Li, Dmytro Abraimov, David Larbalestier (NHMFL)

Introduction

We placed artificial defects with partial current-carrying capability on IBAD YBCO coated conductors to mimic grain boundaries and studied local electric field distribution near these defects with Low Temperature Laser Scanning Microscopy (LTLSM) under different external magnetic field ***B*** orientations.

Experimental

4 grooves were placed on a piece of IBAD YBCO filmat different angles (90°, 60°, 45°, and 30°) with respect to the macroscopic current flow direction (horizontal) with Focused Ion Beam (FIB). 80% of YBCO layer thickness was removed so the grooves approximately had 20% of original conductors' current-carrying capability. LTLSM was done with ***B*** rotating within a-b plane of the film and macroscopic Lorentz force was tuned by changing angle ϕ between ***B*** and current flow direction.

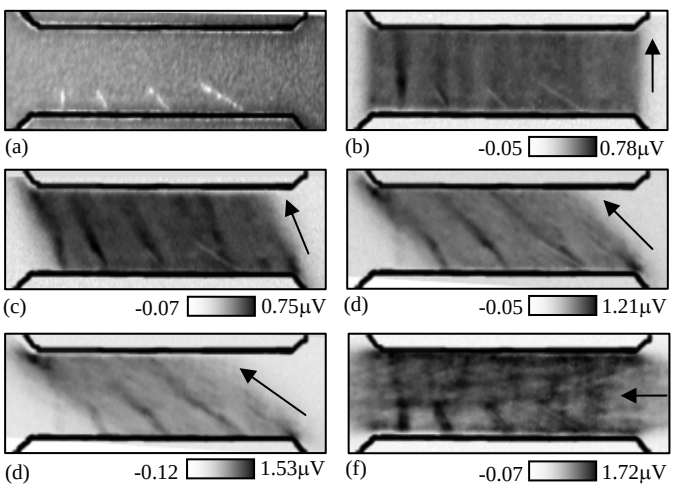

Fig. 1. (a) Optical image; (b)~(f), Variable Lorentz force *dV* maps taken with ϕ= 90°, 60°, 45°, 30° and 0°. Arrows indicate orientation of external magnetic field. Macroscopic current flow direction is horizontal.

Results and Discussion

As shown in Fig. 1 (b)-(e), along each FIB cut, responses were strongest when the cut was parallel to ***B*** and became weaker as the offset between ***B*** and the cut increased. This suggest here that flux penetration into defects parallel to ***B*** is most energetically preferred. In the nominal Lorentz force-free configuration (***B***//I), a highly inhomogeneous response map was observed and responses appeared in areas where none was found in other configuration.

Conclusions

Defects play an important role as channels of flux penetration. Preferential flux penetration into defects is observed when the angle between defects and ***B*** is parallel or small. Defects inclined at large angles to ***B*** are less dissipative.
In the Lorentz force-free configuration, more parts of a YBCO CC become locally dissipative. This imaging condition might be a powerful way to image defects, even those smaller than the resolution limit of LTLSM.

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