Variations of Contact Resistance Between Stabilizer and (Re)BCO in Commercial Coated Conductor Tapes

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Introduction

ReBCO tapes occasionally have process-dependent variations of the contact resistance (R_c) between stabilizer and superconductor which complicate the development of the consistent, low resistance joints needed for low energy dissipation in this new generation of superconducting magnets. Using one defined jointing procedure, we observed about a 5 fold variation of joint resistance for nominally similar tapes at 77K.

Experimental

To understand these variations better, we measured the temperature-dependent contact resistances for Ag-ReBCO and Cu-Ag-ReBCO structures patterned using photo-lithography and wet etching. Following Ekin [1], we estimate the spreading distance (ξ) by measurement of the temperature-dependent resistance R_c obtained by varying the distance between current injection and the voltage leads.

Results and Discussion

Surprisingly, we observed an increasing R_c as temperature decreased from 80 K to 25 K for Ag-ReBCO structures (see **Figure 1**). For different tapes ξ could vary 3-fold at 25 K and R_c 7.5-fold from ≈12 to about ≈90 n$\Omega\cdot$cm^2. The ξ of the Cu-Ag-ReBCO structures varied about 4-fold at 25 K and R_c up to 7 times from ≈42 to ≈300 n$\Omega\cdot$cm^2.

Conclusions

It appears that both stabilizing layers and their interfaces (Ag-ReBCO and Ag-Cu) contribute to this variation of contact resistance. TEM visualization shows an additional 40-70 nm thick layer between Ag and ReBCO that may explain this effect.

Acknowledgements

This work was supported in part by the U.S. National Science Foundation under Grant No. DMR-0654118, DMR-0923070 and the State of Florida.

References

[1] J.W. Ekin *et al.*, APL **32**,331 (1988))

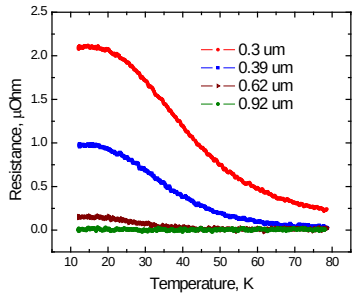

Figure 1. Ag-ReBCO interface. Resistance as function of temperature and distance between current and voltage contacts.

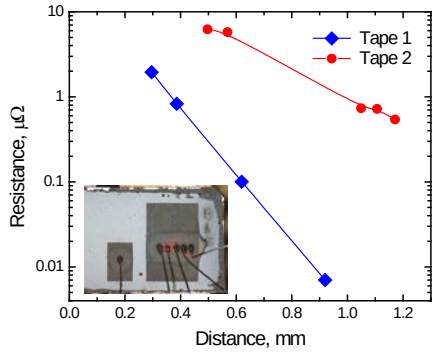

Figure 2. Resistance of Ag-ReBCO interface as function of distance between current and voltage contacts at 25K.

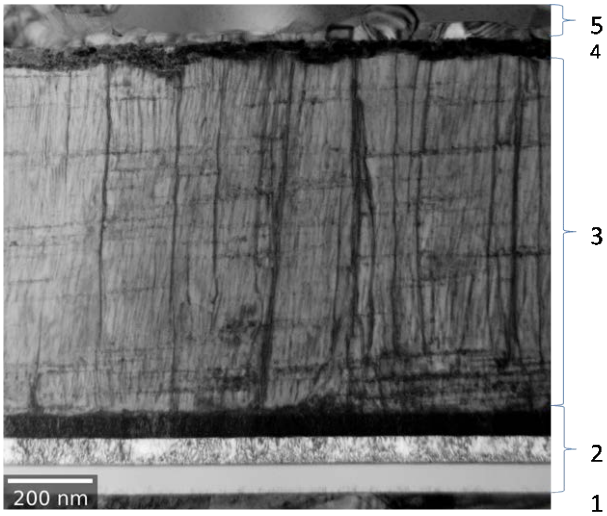

Figure 3. TEM image of cross section with Ag-ReBCO interface with high contact resistance.1-substrate, 2- buffer layer, 3-(Re)BCO, 4-additional layer, 5-Ag.