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ZERO RESISTIVITY AT 81 K IN BSCCO FILMS GROWN FROM LIQUID KCl SOLUTIONS

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Abstract: Textured films of "BSCCO 2212" , with zero resistivity at 81 K, have been grown from KCl liquid solutions, onto (111)-oriented substrates of Gadolinium Gallium Garnet. This technique is particularly promising to grow large epitaxial films of both the "2212" and the "2223" phases of BSCCO.

Films of the high temperature superconductors have been obtained by thermal evaporation, sputtering, and laser ablation. In this paper, we report on the growth of textured films of $Bi_2Sr_2CaCu_2O_{8+x}$ (BSCCO) from a liquid phase, namely a saturated solution of the constituent oxides in molten KCl, which was recently shown[1] to be a suitable solvent for the growth of BSCCO bulk crystals. Our growth procedures are very similar to the ones widely used[2] for the growth of garnet films from $PbO-B_2O_3$ fluxes.

The oxides and carbonates (all at least 99.5 % pure) constituting the BSCCO, were weighed in the atom ratios Bi:Sr:Ca:Cu = 2:2:1:2 , thouroughly mixed in an agathe mortar, put in a 100 cm^3 platinum crucible, and reacted at 900 °C. The KCl powder was added to fill the crucible, and melted in turn at

800 °C. The crucible was then placed in a the upper half of a vertical tubular furnace, so to obtain in the melt a downward thermal gradient of about 2 °C cm^{-1}, at an average temperature of about 850 °C. After an overnight soak, a substrate of Gadolinium Gallium Garnet ("GGG"), (111)-oriented and 1 inch diameter, held in a standard platinum triceps[2], was immersed in the solution (about 1 cm below the melt surface) kept there 4 to 40 h, while slowly (30 rpm) rotating, then extracted, spinned at 400 rpm for 30 s, and slowly withdrawn from the furnace. Film thicknesses up to 3 microns were obtained.

X-ray diffractograms (Fig. 1) show that the films consist of the $Bi_2Sr_2CaCu_2O_{8+x}$ phase, with c=30.73 A, and are highly textured: the c axis is aligned with the normal to the substrate within 1 degree.

The resistive transition of the best films (see Fig. 2) is rather narrow, with R=0 reached at 81 K.

The reported growth technique appears, in principle, very promising to grow large epitaxial films of BSCCO, if more suitable substrates are used (even of the "2223" phase, using higher growth temperatures).

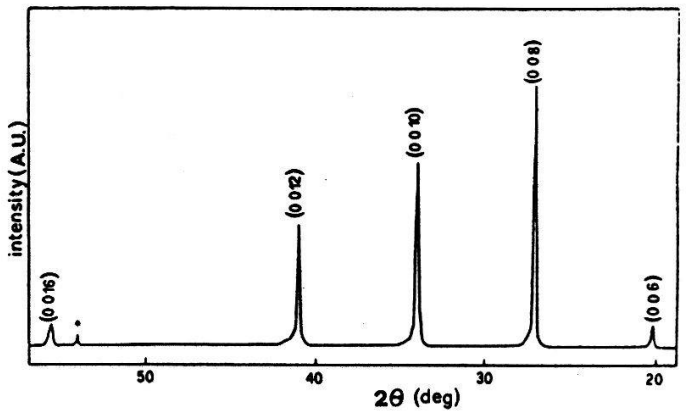

Fig. 1

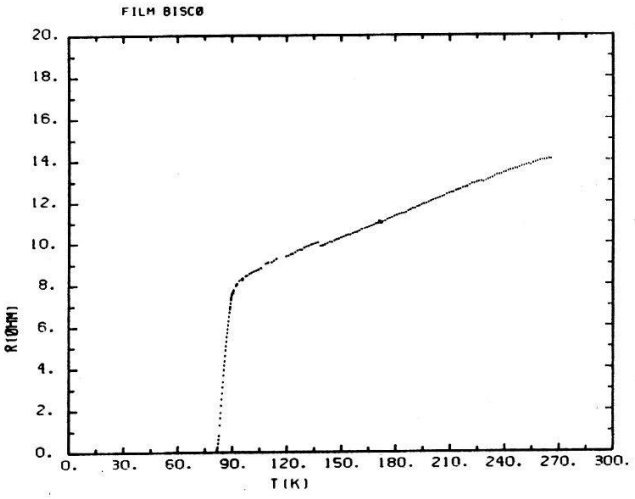

Fig. 2

References

[1] L. F. Schneemayer et al., Nature 332, 422 (1988).

[2] S. L. Blank, J. W. Nielsen, J. Cryst. Growth 17, 302 (1977).