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PYROLYSIS AND OZONE IN THE YBCO FABRICATION PROCESS

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Abstract: Pellets of YBCO have been fabricated by citrate pyrolysis; the annealing is done using a mixture of oxygen and ozone. The process generates textured samples with large micro-crystals. A.C. susceptometers were used for sample characterization which shows remarkable improvements by the use of ozone.

1. Introduction

The high Tc superconducting peroxides are easily obtained by powder mixing and a solid state reaction followed by oxygen annealings and sinterization. In these processes the non-ideal mixing of the components can lead to poor quality samples. An improvement of the YBCO fabrication is obtained by using the pyrolytic method [1] and an ozone enriched oxygen in all thermal treatments.

2. Preparation method and experimental results

The preparation method starts with a nitrate mixture prepared by using Y and Cu oxides and Ba carbonate. Citric acid is added and a neutralization (PH=6.7) with NH_4OH is done [1]. Best results are achieved by a direct optical method observing the formation of a clear light blue solution. The liquid is heated up until it fires leading to a very fine powder. A single thermal treatment in an ozone atmosphere with usual thermal cycles leads to the 123 phase with very few spurious materials undetectable by x-ray and neutron diffraction analysis. The

superconducting powder is sintered in pellets with density 5.5-5.9 g/cm^3 which show the presence of quite large crystals (300 μm) with a preferential orientation [2].
The volume superconducting properties are measured by an a.c. susceptibility technique which detects the absence of spurious phases, the homogeneity of the samples and the grain coupling strength. A simple two coil system is used, where the sample is surrounded by the pick up coil inside a coaxial exciting coil. A two phase lock-in amplifier detects the susceptibility components. The temperature is monitored by a suitable silicon diode. As shown in fig.1, at low magnetic field, the transition

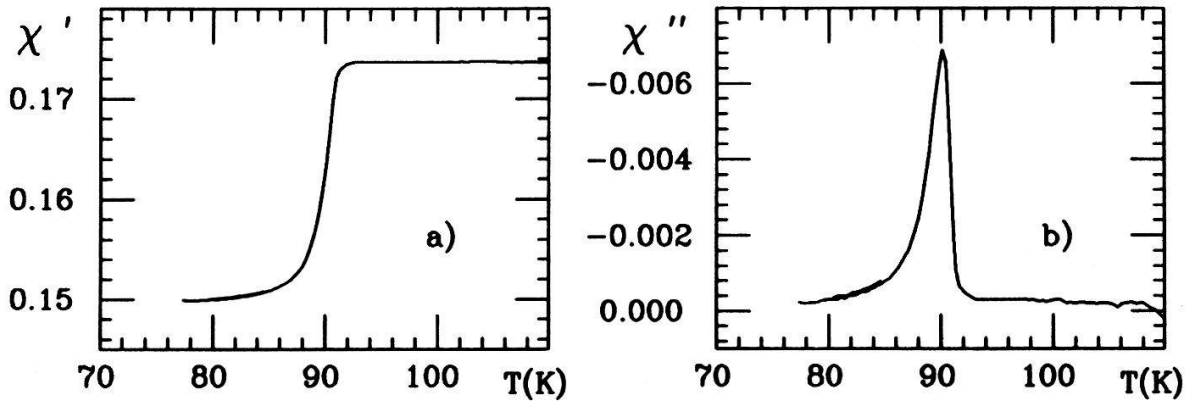

Fig.1. In phase a) and out of phase b) susceptibility signal: frequency 1KHz, amplitude of the exciting field 5 Gauss.

width (interval between 10% and 90% of the complete shielding), is very narrow (≃2K). The increase of the magnetic field does not reduce Tc but enlarges ΔTc. Up to 5 Gauss it is hard to separate the grain coupling from the grain transitions. Several comparative measures between samples made with oxygen and samples made with ozone, confirm improvements by using ozone for the YBCO fabrication and in particular a stronger resistance against water and moisture.

3. References

[1] D.H.A.Blank et al.,Physica 145B, 222 (1987).
[2] F.Celani et al., ASC-88 to be pub. on IEEE Trans. on Magn.