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SUPERCONDUCTIVITY ABOVE 90 K IN THE Y-Ba-Cu-O COMPOUND SYSTEM

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Summary Preliminary results on high T_c superconductors are reported. One of the Y-Ba-Cu-O compound systems has been fabricated. The temperature dependence of the resistance has been determined. The critical temperature of the samples annealed in oxygen atmosphere is well above the normal boiling point of liquid nitrogen.

Riassunto Vengono riportati risultati preliminari su superconduttori ad alta T_c . E' stato prodotto uno dei composti del tipo Y-Ba-Cu-O. E' stata determinata la dipendenza della resistenza dalla temperatura. I campioni ricotti in atmosfera di ossigeno hanno mostrato una temperatura critica ben al di sopra della temperatura di ebollizione dell'azoto liquido a s.t.p.

In the last period, after the discovery by Bednorz and Muller of the existence of superconductivity up to 35 K in the La-Ba-Cu-O compound system [1], a great deal of effort has been devoted to the search of similar high critical temperature compounds [2-6].

Superconducting transition above 77 K, the liquid nitrogen boiling point at ambient pressure, has been reported in the Y-Ba-Cu-O compound system [4-6], with onset temperatures of 93 and 98 K.

In the following we report on the superconducting behavior of such kind of compounds.

The samples were prepared by solid state reaction [7] in platinum crucibles, using an appropriate mixture of Y_2O_3 , $BaCO_3$ and CuO . The nominal composition used was $(Y_{0.6}Ba_{0.4})CuO_{4-y}$. The mixture was first heated a few hours at $900^\circ C$ in oxygen atmosphere. The process was repeated after grinding the reacted mixture. The compound then was ground again, mixed with an organic binder, pressed into a 10 mm diameter cylinder at 4 Kbar and reheated to $900^\circ C$ for sintering for 24 hours. The dc resistance R was measured by the four points method. Spring loaded copper beryllium contacts were used. The temperature dependence of R was obtained in a fiberglass dewar filled with liquid nitrogen.

A silicon diode thermometer has been used to measure the temperature. Its sensitivity was -2.75 mV/K with 10 μA bias current. R vs T curves are shown in Fig.1. Dots refer to a sample obtained by the aforementioned method. The zero resistance state in absence of magnetic field is reached well above the normal boiling point

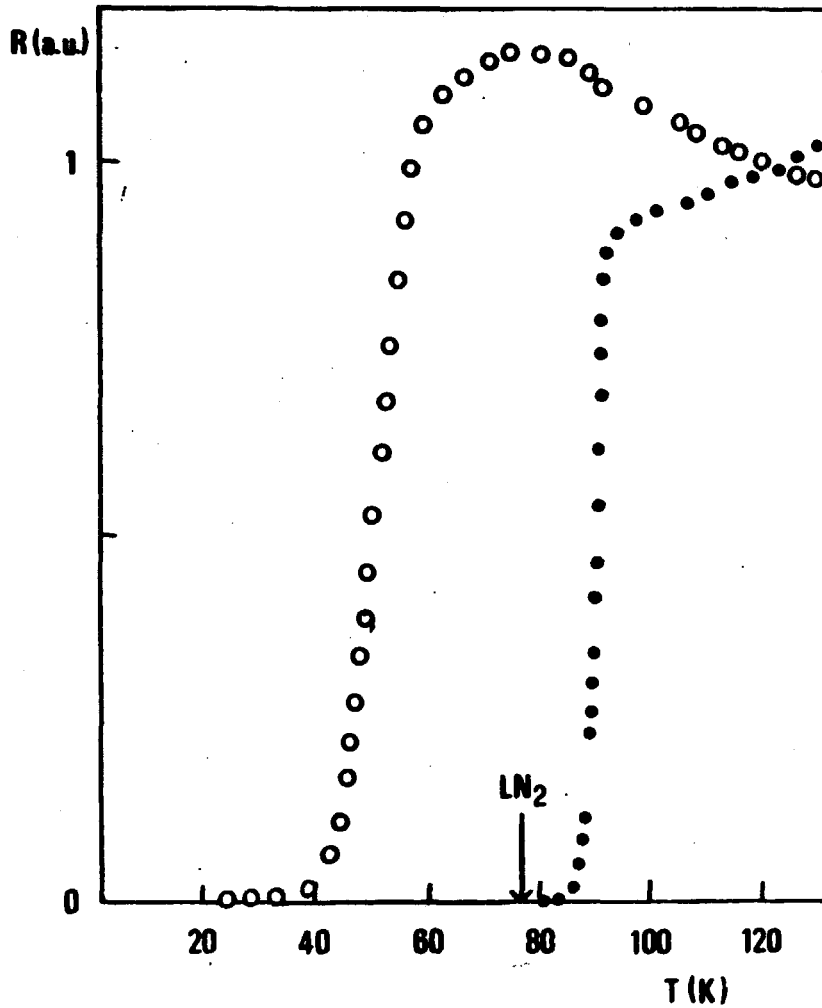


Fig. 1

Temperature dependence of resistance,
measured in a liquid nitrogen dewar.

of LN_2 (~ 77 K). In the same figure the temperature dependence of a sample obtained by a different procedure is also shown (open circles). In this latter case the sample was first annealed in air and finally sintered in oxygen atmosphere. More dramatic effects were observed in samples annealed in nitrogen atmosphere, namely a high resistance (\sim few $M\Omega$) and a typical semiconductor-like behavior.

Preliminary X-ray diffraction spectra have been taken of the sample exhibiting the superconducting transition at 93 K and of the one annealed in nitrogen atmosphere. Both samples show the existence of a large number of phases, none of which of the K_2NiF_4 type, in agreement with the results of Ref.4. No significant difference is observed between the two diffraction patterns. Further investigation is in progress.

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