

## POSSIBLE SUPERCONDUCTIVITY ABOVE 230 K IN Y-Ba-Cu-O SYSTEM CONTAINING Sr AND Ca

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### ABSTRACT

Systems of  $Y_2 Ba_{2-x} Sr_x Cu_3 O_{8-y}$  (where  $x = 0.2$  and  $1$ ) and  $Y Ba_{2-x} Ca_x Cu_3 O_{9-y}$  (where  $x = 0$  to  $2$ ) were studied. Results obtained on these multiphase systems show the possible existence of phases which might become superconducting above 230 K.

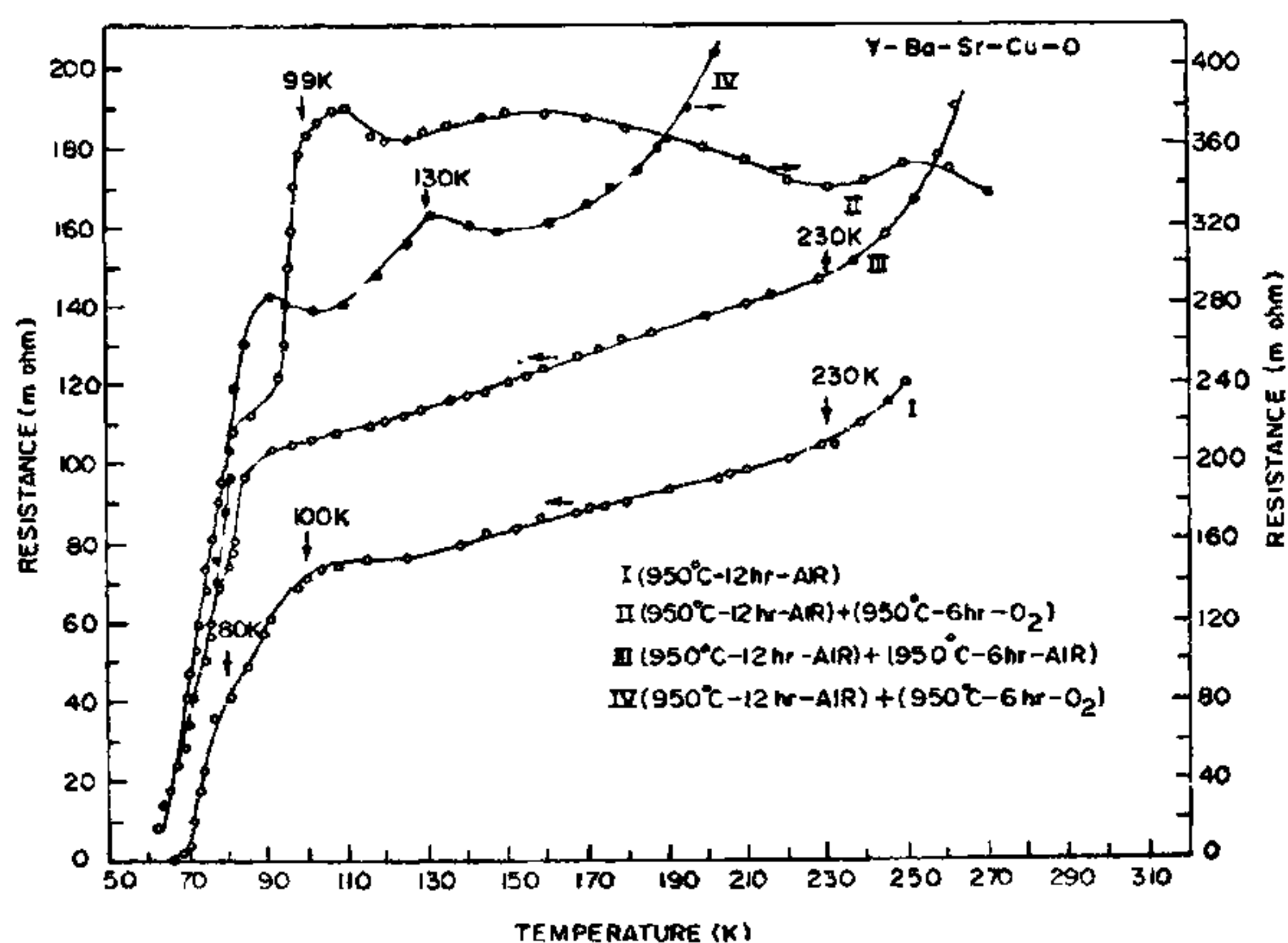
UNPRECEDENTED excitement in the area of superconductivity is generated by the recent discovery of mixed metal oxide system of Y-Ba-Cu-O possessing  $T_c$  of around 90 K<sup>1</sup>. This is followed by observations made through the resistive studies of the onset  $T_c$  of 130 to 140 K<sup>2,3</sup> and also in some cases superconductivity persisting up to 230 K or 240 K as revealed by inverse a.c. Josephson effect studies<sup>4,5</sup>. This apart, there have been unconfirmed reports of  $T_c$  values exceeding these temperatures. In this note we draw attention to rapid resistance drops above 230 K which we have observed in Y-Ba-Cu-O system containing varying amounts of Sr or Ca.

The samples were prepared by direct oxide mixing technique described elsewhere<sup>6</sup>. Figure 1 depicts the resistance variation with temperature of samples of  $Y_2 Ba_{1.8} Sr_{0.2} Cu_3 O_{8-y}$  prepared through different heat-treatment schedules. Resistance variation of the sample prepared by heat treating the mixture at 950°C for 12 hr in air followed by 6 hr of sintering at the same temperature in air showed a prominent

resistance drop above 230 K in addition to superconducting resistance drop below 86 K. The compound  $Y_2 Ba Sr Cu_3 O_{8-y}$  prepared under identical conditions shows over 60% drop in resistance as the temperature is reduced from 270 K to 230 K (figure 2). This consistent observation in samples sintered in air suggests the likelihood of superconductivity above 230 K with onset beyond 270 K.

In the inverse a.c. Josephson effect measurements where the unbiased sample containing superconducting weak links, when irradiated with microwaves, develops d.c. voltage. These studies put an upper limit to the superconducting transition at 299 K, that is + 26°C. A full account of these measurements forms a subject matter of a separate communication.

X-ray diffraction studies performed on the above samples indicate the presence of different phases. In the spectrum the diffraction peaks corresponding to  $Y_1 Ba_2 Cu_3 O_{9-y}$ , having  $La_3 Ba_3 Cu_6 O_{14}$  type tetragonal (or distorted) structure, have been identi-



**Figure 1.** Resistance variation with temperature in  $Y_2 Ba_{1.8} Sr_{0.2} Cu_3 O_{8-y}$  samples with different heat treatments.

\* \* For correspondence.

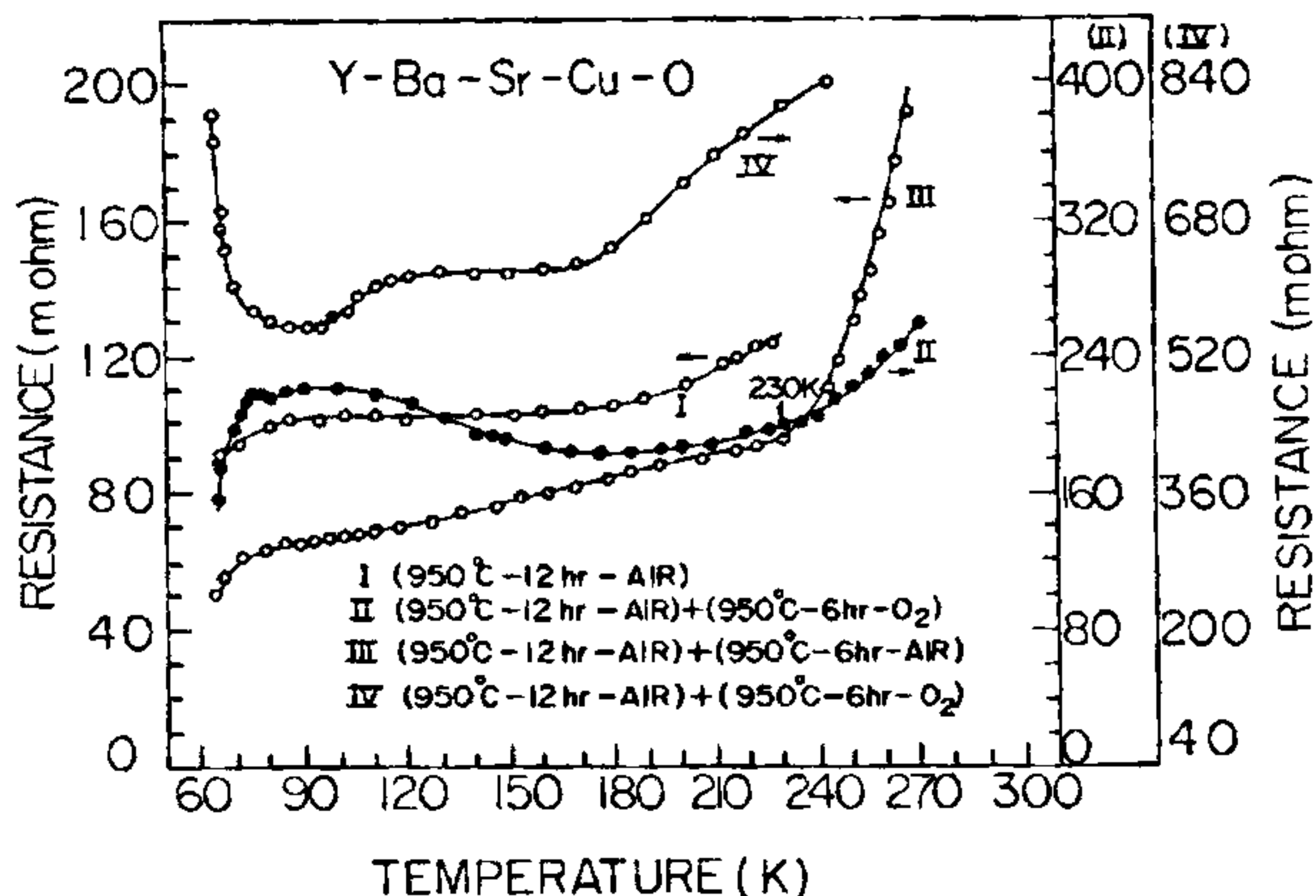


Figure 2. Resistance variation with temperature in  $Y_2 Ba Sr Cu_3 O_{8-x}$  sample.

fied and the identification of the phase responsible for the resistance drop around 230 K is in progress.

Interestingly, the compound  $Y Ba_{1.25} Ca_{0.75} Cu_3 O_{9-y}$  and  $Y Ba Ca Cu_3 O_{9-y}$  prepared by reacting the materials in the pellet form at 950°C for 12 hr in air followed by sintering in oxygen also showed promin-

ent resistance drop above 240 K (figure 3). These observations give credence to the above results as strontium and calcium are isovalent. The multiphase character of the samples indicate that the phase responsible for the superconducting-like transition above 230 K is different from the so far tried

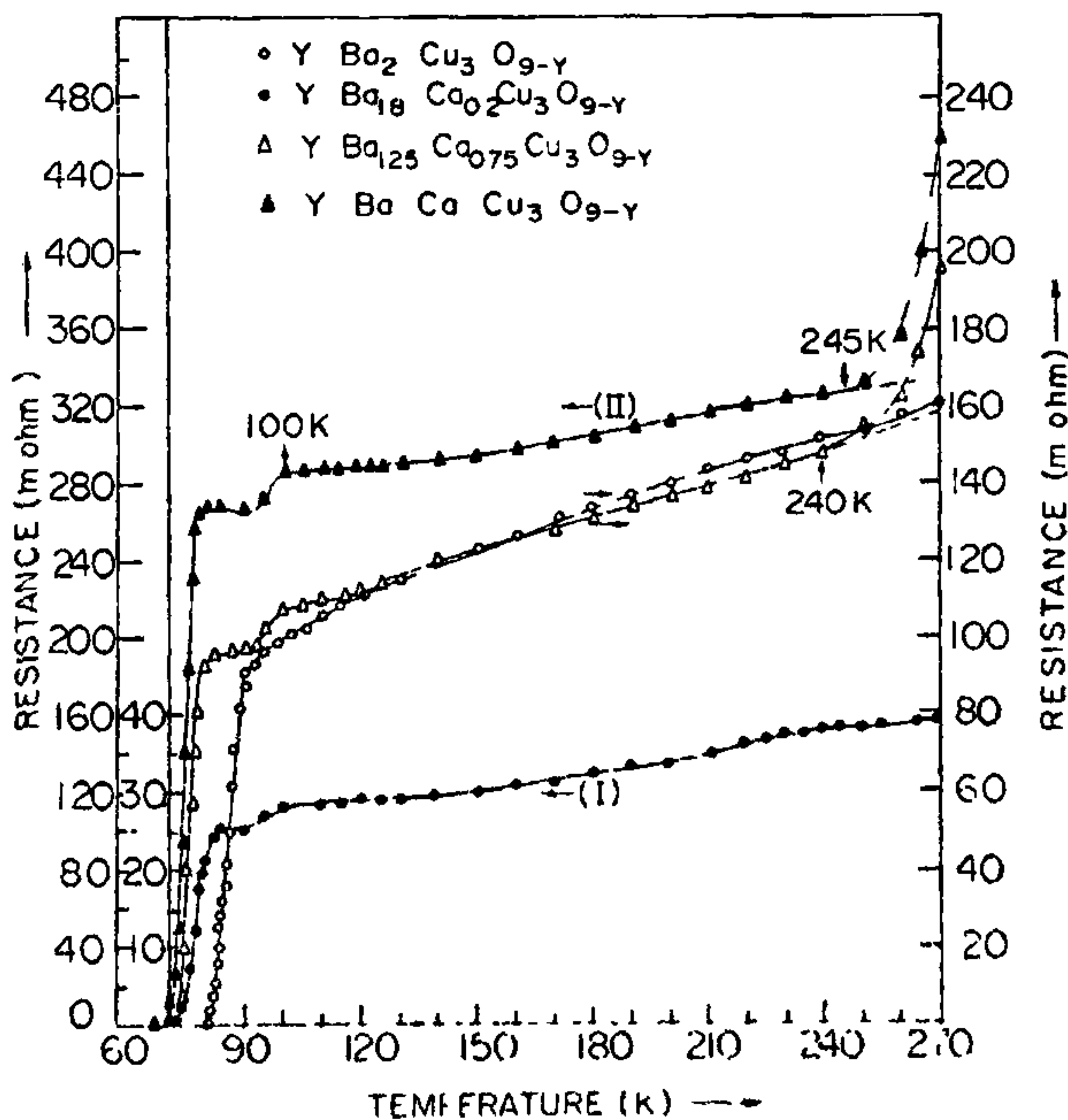


Figure 3. Resistance variation with temperature in  $Y_2 Ba_{2-x} Ca_x Cu_3 O_{9-y}$  samples with  $x = 0$  to 2.

compositions 1:2:3 and 2:2:3 of Y:Ba:Cu. The inverse a.c. Josephson effect<sup>4</sup> in  $Y_1 Ba_2 Cu_3 O_{9-y}$  sample indicated the persistence of superconducting weak links up to 230 K. This however was not reflected in resistance measurements. This particular phase presumably may have been stabilized in the presence of Sr and Ca.

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### ANNOUNCEMENT

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