Temperature Dependence of Electrical Resistivity for pure and Ag Doped Bi-Pb-Sr-Ca-Cu-O Superconductor

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The temperature dependent resistance of pure and Ag doped Bi-Pb-Sr-Ca-Cu-O has been observed. It has been found that Ag additions to Bi-Pb-Sr-Ca-Cu-O depress T_c and J_c drestically and cause a large decrease in lattice parameters when samples are treated in air or pure oxygen. However, the lattice parameters T_c and J_c remain unaffected by Ag additions when samples heated in 0.030-0.067 atm oxygen. It is clear that the Ag reacts with and destabilises the superconducting phase when the samples are treated in air or pure oxygen while, when the samples are heated in low oxygen partial pressures, the Ag remains as an isolated inert metal phase that improves the week links between the grains.

Keywords: Electrical Resistivity, ceramics, superconductivity

1. INTRODUCTION

The subsequent discovery of hige T_c oxide *Bi-Pb-Sr-Ca-Cu-O* has stimulated into research work. Silver (Ag) has been used in the making of *Bi-Pb-Sr-Ca-Cu-O* superconductor composite wires, tapes and multifilaments and it has been found to be the only metal element among the Noble metal that is non-poisoning to ceramic superconductors [1]. This non-poisoning behaviour of Ag is of significant technical importance in fabrication of Ag superconductor composites because it offers the attractive features of the possibility of a current that improved environmental resistance and improved mechanical behaviour such as flexibility and durability [2].

2. EXPERIMENTAL STUDY

The sample was prepared by mixing Bi_2O_3, PbO, $SrCO_3$,$CaCO_3$ and CuO and calcinating at 800^0C for 24 hours in air with intermediate grindings[3, 4]. The precursor powder was mixed with 10-30 wt% Ag powder pressed into pellets and sintered at 800-840^0C in oxygen-nitrogen mixture with Po_2 = 0.010–1.000 atm for 50 hours. For comparison, samples without Ag additions were also prepared by the same processing route. The electrical resistivity was measured on the bar shaped specimen by standard four-probe DC technique [5].

3. RESULTS AND DISCUSSION

Figure 1 shows temperature dependence of resistivity for 0 to 30 wt% Ag-doped samples treated in pure oxygen (1.000 atm O_2).

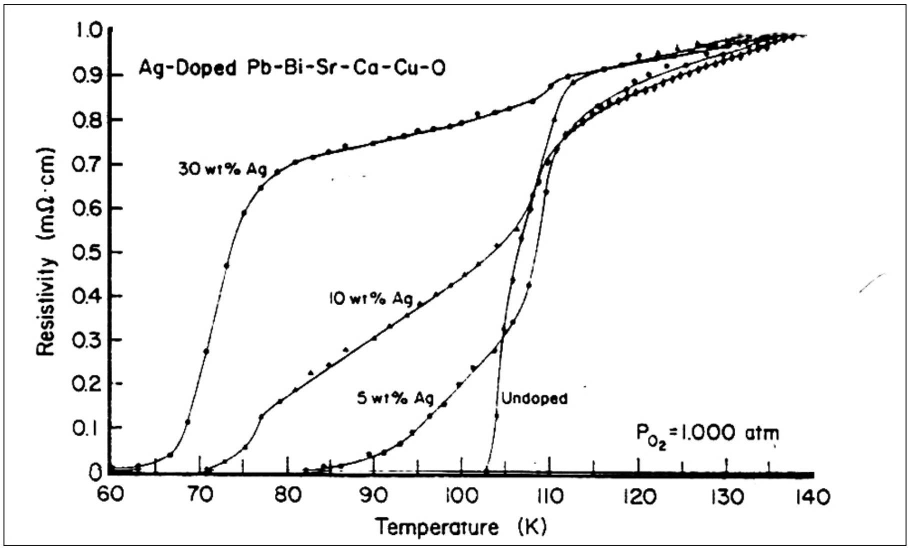

Fig. 1: Variation of resistivity with temperature for Ag-doped samples sintered under pure oxygen (1.000 atm O_2).

Figure 2 shows the temperature dependence of resistivity for 0 to 30 wt% Ag-doped samples treated in air (0.209 atm O_2).

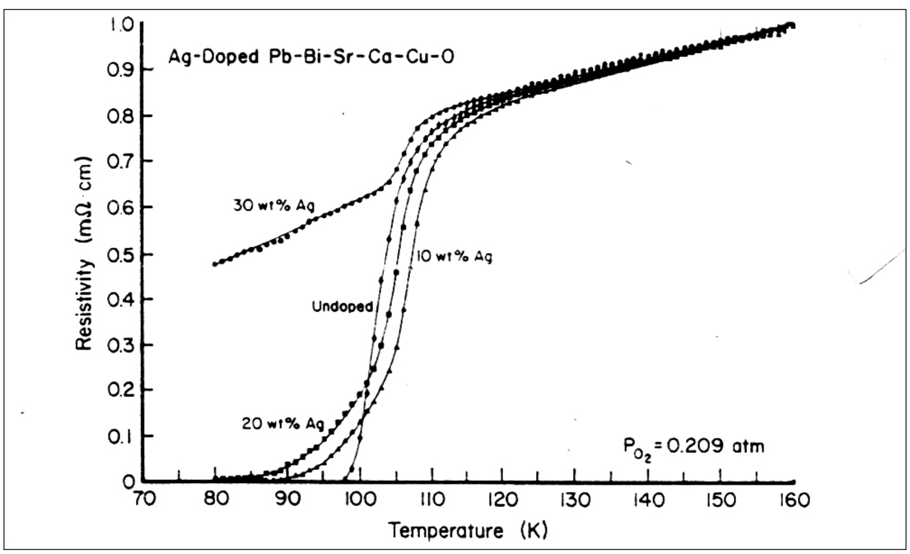

Fig. 2: Variation of resistivity with temperature for Ag-doped samples sintered under air (0.209 atm O_2).

It has been observed that non-poisoning behaviour of Ag to (BPSCCO) samples sintered in oxygen. Ag additions drastically suppressed the superconducting transition of (BPSCCO) when samples were sintered in air and oxygen. These observations indicate a strong chemical reaction between Ag and (BPSCCO) superconductors. This discovery is of significant technological importance for the fabrication of Ag-(BPSCCO) composites such as Ag-clad wires, tapes and multifilaments.

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