UNIVERSITI TEKNOLOGI MARA

EFFECT OF SILVER (Ag) AND ANTIMONY (Sb) SUBSTITUTION ON Ba-SITE OF POROUS STRUCTURED $YBa_2Cu_3O_\delta$ SUPERCONDUCTOR

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Thesis submitted in fulfillment of the requirements
for the degree of
Master of Science

Faculty of Applied Sciences

April 2011

Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. The topic has not been submitted to any other academic institution or non-academic institution for any other degree of qualification.

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ABSTRACT

In this work, the effect of silver (Ag) and antimony (Sb) substitution on Ba-site of porous structure $YBa_2Cu_3O_\delta$ (YBCO) superconductor was investigated. Polycrystalline sucrose was used as a supplementary filler to create the open pores in the structure. Two series of sample with a nominal composition of $YBa_{2-x}Ag_xCu_3O_\delta$ and $YBa_{2-x}Sb_xCu_3O_\delta$ where x = 0.05, 0.10, 0.15, 0.20, 0.30, 0.40 and 0.50 were synthesized and characterized. Standard sample and porous $YBa_2Cu_3O_\delta$ were also prepared for comparison. All the samples were prepared via solid state technique and undergo characterization by using X-ray diffraction (XRD) method, resistivity measurement technique and Scanning Electron Microscopic (SEM) equipment. All porous Ag doped sample showed metallic behavior at the normal state and have $T_{C\ onset}$ around 90 K. $T_{C\ zero}$ was decreased as the Ag concentration increased. Optimum Ag concentration was achieved at x = 0.20 where $T_{C\ zero}$ and J_C at 70 K has the highest value of 87 K and 16.50 A/cm^2 respectively. For porous Sb doped sample with $x \leq 0.30$, the samples showed metallic behavior above $T_{C\ onset}$ while semiconducting behavior was shown for $x \geq 0.40$. The optimum Sb concentration was achieved at x = 0.15 where $T_{C\ zero}$ is 85 K and J_C value measured at 70 K is 2.75 A/cm^2. $T_{C\ onset}$ and $T_{C\ zero}$ of the sample were suppressed towards higher Sb concentration. High level of Sb concentration resulted in the non superconducting sample and was not incorporated properly into YBCO system. Generally, the crystallographic structure with 123 phase remains as orthorhombic for all samples with the presence of some impurities at the high level of doping. However, for Sb doping at x = 0.30, the sample exhibits tetragonal structure before the presence of 211 phase with the increase of Sb concentration. SEM micrograph for porous sample showed the less dense packing with irregular grain shape compared to the standard sample where the small rounded particles grains that can be clearly seen. From the overall result, it can be summarized that the superconducting properties were attributed mainly by the dopants compared to the porous characteristic and porous Ag doped sample showed better superconducting properties compared to the porous Sb doped sample.

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