A study of Bi$_{1.6}$Pb$_{0.4}$Sr$_{2-x}$Ba$_x$Ca$_2$Cu$_3$O$_y$ superconductor is made by sol-gel method

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Abstract: In this study, the effect of Ba substitution for Sr in the Bi-Pb-Sr-Ca-Cu-O (BPSCCO) system was investigated. The Bi$_{1.6}$Pb$_{0.4}$Sr$_{2-x}$Ba$_x$Ca$_2$Cu$_3$O$_y$ superconductor with $x = 0.0, 0.05, 0.1, 0.15, 0.2, 0.25$ and $0.3$ at annealing times of $16, 32, 48$ and $64$ hour was made by the sol-gel method. In order to study the microstructure of samples, SEM images and X-ray diffraction (XRD) was performed. The crystal lattice parameters of this compound were measured by using of diffraction angles and miller indices. The critical current density, critical temperature and at room temperature, resistivity of the samples were measured by four probe method. The results indicated that improved superconducting properties with Ba doping and the maximum values of the Bi-2223 phase fraction, critical temperature, current density and at room temperature resistivity are obtained for sample at annealing time of $32$ hour with the Ba content $x = 0.2$. Also, the results show that the critical current density decreases by increasing annealing time. The volume of the unit cell was increased by increasing the Ba doping, which indicates substitution of Sr by the Ba, with larger ionic radius.

Keywords: Bi$_{1.6}$Pb$_{0.4}$Sr$_{2-x}$Ba$_x$Ca$_2$Cu$_3$O$_y$ superconductor, sol-gel, Barium, critical temperature, critical current density, at room temperature resistivity.

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