

Pressure-induced superconductivity in $\text{Bi}_{1-x}\text{Sb}_x$ alloy

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Bismuth-antimony alloy ($\text{Bi}_{1-x}\text{Sb}_x$) is a substitutional solid solution over the full concentration range, and crystallizes in the A7-structure with space group $R\bar{3}m$ at ambient condition. In this study, we performed the electrical resistivity and x-ray diffraction measurements of $\text{Bi}_{1-x}\text{Sb}_x$ under hydrostatic pressure up to 10 GPa. Pressure-induced superconducting transitions were observed at all concentrations measured. The transition temperatures (T_c) are $T_c \sim 7$ K at around 3-4 GPa for $x = 0.15, 0.4, 0.6$ and $T_c = 4.6$ K at 8 GPa for $x = 0.8$, which are consistent with the results by Il'ina.¹ The effect of pressure on the superconductivity changes at $x \sim 0.7$, namely negative for $x \leq 0.6$ and positive for $x = 0.8$. On the other hand, applying pressure causes the structural change from the A7-structure to an incommensurate host-guest composite one.² Our structural studies for $x = 0.15, 0.4, 0.6$ at ambient temperature show that the high-pressure phase starts to be formed at $P \sim 3.5$ -4.5 GPa. Thus, we infer that the superconducting transition in $\text{Bi}_{1-x}\text{Sb}_x$ occurs in the incommensurate host-guest composite structure.

¹M. A. Il'ina, Sov. Phys. Solid State **18**, 600 (1976) & **22**, 494 (1980).

²U. Häussermann, O. Degtyareva, *et al.*, Phys. Rev. B **69**, 134203 (2004).