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# Influence of Boron-Containing Dopants on Superconducting Properties of (Bi, Pb)-2223 HTS

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## Abstract

The influence of addition of lead borate $Pb(BO_2)_2$ and boron oxide $B_2O_3$ on the phase evolution and superconducting properties of (Bi, Pb)-2223 HTSs synthesized by the solid-state reaction method in alumina crucibles has been studied. X-ray diffraction, resistivity, critical current density, and AC susceptibility measurements were performed on the prepared compounds. Obtained results have shown that boron-containing dopants lead to the drastic enhancement of the (Bi, Pb)-2223 phase formation. Boron-doped samples reveal a significant increase in both the zero resistivity temperature and transport critical current density compared to the undoped specimen. On the other hand, a high content of boron-containing dopants

causes the appearance of a very low-$T_c$ 2201 phase and leads to a deterioration of coupling between superconducting grain boundaries. Obtained results could enable us to develop a cheap and energy efficient fabrication technology for nearly single (Bi, Pb)-2223 phase superconducting materials via heat treatment of boron-incorporated precursors in an alumina crucibles.

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## References

1. Eltsev, Y., Lee, S., Nakao, K., Tajima, S.: The electrical transport properties of high quality Bi-

2223 crystal. Supercond. Sci. Technol. **23**, 055007 (2010). doi:10.1088/0953-2048/23/5/055007

2. Liang, B., Bernhard, C., Wolf, Th., Lin, C.T.: Phase evolution, structural and superconducting properties of Pb-free $Bi_2Sr_2Ca_2Cu_2O_{10+\delta}$ single crystals. Supercond. Sci. Technol. **17**, 731–738 (2004)

3. Garnier, V., Monot-Laffez, I., Desgardin, G.: Kinetics study of the Bi-2223 grain growth thickness. Physica C **349**, 103–112 (2000)

4. Takano, M., Takada, J., Oda, K., Kitaguchi, H., Miura, Y., Ikeda, Y., Tomii, Y., Mazaki, H.: High-$T_c$ phase promoted and stabilized in the Bi, Pb–Sr–Ca–Cu–O system. Jpn. J. Appl. Phys. **27**, L1041–L1043 (1988)

5. Watanabe, K., Kojima, M.: The effect of $V_2O_5$ additive on the high-$T_c$ (2223) phase of Bi–Pb–Sr–Ca–Cu–O system superconductor. Supercond. Sci. Technol. **11**, 392–398 (1998)

6. Margiani, N.G., Medoidze, T.D., Metskhvarishvili, I.R., Papunashvili, N.A., Zhghamadze, V.V., Dzanashvili, D.I., Aliyev, V.A.: Enhancement of (Bi, Pb)-2223 HTS

formation by boron-doping. J. Supercond. Nov. Magn. **23**, 1241–1243 (2010)

7. Khavronin, V.P., Luzianin, I.D., Ginzburg, S.L.: Dynamical magnetic susceptibility in Y–Ba–Cu–O near $T_c$. Phys. Lett. A **129**, 399–403 (1988)

8. Ghattas, A., Annabi, M., Zouaoui, M., Ben Azzouz, F., Ben Salem, M.: Flux pinning by Al-based nano particles embedded in polycrystalline (Bi, Pb)-2223 superconductors. Physica C **468**, 31–38 (2008)

9. Guilmeau, E., Andrzejewski, B., Noudem, J.G.: The effect of MgO addition on the formation and superconducting properties of the Bi2223 phase. Physica C **387**, 382–390 (2003)

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