STRUCTURAL, TRANSPORT AND MAGNETIC PROPERTIES OF BI-BASED HTSC WITH LOW DENSITY

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Superconducting materials in foam form can be considered as a novel class among single crystals, films and bulks superconductors. These materials have unusual and specific properties attractive for applications in many areas. Superconducting foam structures [1] may be an ideal materials for some practical applications of HTSCs, for example, one can use the materials made from superconducting foam as an active element of fault current limiters and superconducting bearings. Porous structure of these materials provide good heat exchange between HTSC crystallites and liquid nitrogen, so the formation of hot-spots can be avoided which results in increasing of current-carrying capability in spite of lowering of duty factor. Superconducting foams also have a fundamental interest connecting with study of flux pinning and flux flow processes in porous media with fractional dimension.

In this work the procedure of synthesis, transport and magnetic properties of $Bi_{1.8}Pb_{0.3}Sr_{1.9}Ca_2Cu_3O_x$ with low density and micro-foam structure are presented.

The SEM shows the plate-like crystallites with approximately uniform thickness (about 1-2 μm) which oriented significantly random. The boundaries between the crystallites have a linear form in the image field. The pore-boundary surface is open, which was observed by liquid nitrogen penetration.

The temperature dependence of resistivity for this material was resemble to that for single Bi-2223 crystals [2], i.e. linear extrapolation of $\rho(T)$ curve from the high temperature range to zero temperature gives the value of residual resistivity $\rho \approx 0$. This fact points out that the influence of intergrain boundaries in the porous material on the the current carrying properties is negligible.

Magnetic measurements shows that the shape of $M(H)$, $M(T)$ dependencies are the same, but the absolute value of diamagnetic response is higher more than in two times in case of porous superconducting material than that for the polycrystalline one.

This work is supported by program of President of Russian Federation for support of young scientists, grant MK 1682.2004.2., and by Krasnoyarsk Regional Scientific Foundation (KRSF), grant 12F0033C.

References

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