Nanocomposites and nanomaterials

Pinning in MgB2 bulk superconductors manufactured under high pressure

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Experimental studies of formation of the structure in superconducting materials magnesium diboride based materials were performed in depending on the synthesis parameters under 30 MPa and 2 GPa. It was shown that a significant increase in the critical current density at a low magnetic field and a certain decrease in high magnetic fields by increasing the synthesis temperature of 600 to 1050 °C [1-2] followed by transformation of Mg-B-O nanolayers into separate Mg-B-O inclusions and by a reduction of MgBx inclusions (x > 4 for materials prepared at 30 MPa and usually x = 10-14 for 2 GPa). Comparing the structures and characteristics of MgB_2 leads to the conclusion that the most important role for pinning is played by the distribution of admixed oxygen in the structure of superconductor and that its notably high amount (up to 17 wt %) is not an obstacle for very good superconducting characteristics. MgB2 bulks manufactured under pressure of 30 MPa and 2 GPa showed 73-98% connectivity and 75-100% shielding fraction, at that it was not detected MgO by SEM and Auger techniques. Presence of some (up to 13 wt %) MgO at the x-ray pattern can be explained by solid solutions of boron in the magnesium oxide structure, whereas Auger study [3] showed that some oxygen is solved in the MgB_2 matrix as $MgB_{1.7\text{-}2.2}O_{0.4\text{-}0.6}$ according to a quantitative analysis.

1. *Prikhna T.A., Gawalek W., Savchuk Ya.M., Moshchil V.E., Sergienko N.V., Habisreuther T., Wendt M., Hergt R., Schmidt Ch., Dellith J., Melnikov V.S., Assman A., Litzkendorf D., Nagorny P.A.* // Phisica C. – 2004. – **402.** – p. 223-233.
2. *Prikhna T., Chaud X., Gawalek W., Rabier J., Savchuk Y., Joulain A, Vlasenko A., Moshchil V., Sergienko N., Dub S., Melnikov V., Litzkendorf D., Habisreuther T., Sverdun V.* // Physica C. – 2007. – **460.** – p.392.
3. *Muralidhar M., Sakai N., Chikumoto N., Jirsa M., Machi T., Nishiyama M., Wu Y., Murakami M.* // Phys. Rev. Lett. – 2002. – **89. –** No 23 237001_1.