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Structure and pinning centres in MgB_2 bulk, wires and thin films and in MT-YBCO

ABSTRACT. The structure and composition of MgB_2-based materials (bulk, wires and thin films) prepared at different pressures (0.1 MPa–2 GPa) and temperatures (600–1050 °C), and melt-textured $YBa_2Cu_3O_{7-\delta}$ (MT-YBCO) oxidized in oxygen flow at 440 °C and under hydrostatic pressure of 16 MPa at 800 °C, which demonstrated high critical current densities j_c, were analysed by X-rays, SEM–EDX and TEM. Correlations between the character of material inhomogeneities, which can be pinning centres and influence superconducting characteristics, are discussed. The effect of defects such as twins, dislocations, macrocracks and microcracks on critical current density and mechanical characteristics of MT-YBCO is considered. Regularly distributed nanostructural inhomogeneities responsible for pinning and connected with Mg, B and O content variation in the nanoscale were observed in all types of the MgB_2-based materials. The effect of homogeneity of the matrix phase of MgB_2 wires, with and without additions of carbon and dysprosium oxide, as well as the ratio of Mg to B on the critical current densities in the wires, were established.

Keywords: electron microscopy, mechanical characteristics, MgB_2, superconducting materials, $YBa_2Cu_3O_{7-\delta}$

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