NANOSTRUCTURAL SUPERCONDUCTING MATERIALS FOR FAULT CURRENT LIMITATERS AND CRYOGENIC ELECTRICAL MACHINES

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The superconductive nanostuructural materials of the Y-Ba-Cu-O and Mg-B-O systems with high critical current densities, high fields of irreversibility, hardness, fracture oughness, Young modulus can trap high magnetic fields and can be efficiently used for the cryogenic technique, in particular in electromotors, cryogenic pumps, fault current limiters, magnetic bearings, fly-wheel energy storage devices, MAGLEV transport, magnetron-sputtering devices, etc. operating at liquid nitrogen and hydrogen temperatures.

We discuss the problems of manufacture of melt-textured quasi-singledomained $YBa_2Cu_3O_{7-\delta}$ - based (MT-YBCO) and polycrystalline (with 15-35 nm grains) $Mg(B,O)_2$ materials with high superconducting and mechanical properties, the dependence of their superconducting (magnetic) and mechanical properties on the structural defects and inhomogeneities such as twins, dislocations, stacking faults, micro- and macrocracks, distribution of oxygen enriched and MgB_{12} inclusions, material's chemical composition and grain sizes etc. The peculiarities of products for superconducting electromotors and fault current limiters will be considered.

Melt textured method allows us to produce MT-YBCO high-quality blocks of size up to 45×45×18 mm^3 and 90×45×18 mm^3; and using high pressure (2 GPa)-high temperature technique the $Mg(B,O)_2$ blocks of 62 mm in diameter and 20 mm thick; as well as the ring-shaped products and parts of complicated configuration from the above blocks.