Accelerator Physics Seminar
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Superconductors with high critical current densities for high field magnets

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Abstract

At the present day, superconducting magnets for various purposes are based either on NbTi and Nb_3Sn ("Low T_c" materials) or on Bi,Pb(2223) und Bi(2212) ("High T_c"). Important efforts are actually undertaken to further improve their properties, as well those of other materials, e.g. Y(123), Nb_3Al and more recently, MgB_2. The physical properties of these superconductors and their transport critical current densities under operation conditions are presented and discussed.

From the technical point of view, the main requirements to be fulfilled for an industrial superconductor are high critical current densities, J_c, and enhanced values of the upper critical fields, B_{c2}. Due to the fundamentally different properties of all these materials, a large number of fabrication techniques has been developed and optimized. At the same time, however, the choice of the really employed techniques is dictated by an increasing pressure on the production costs. The most successful preparation techniques will be briefly presented.

There is an increasing market for high field magnets ($B \geq 21T$), either for laboratory use or for nuclear magnetic resonance spectroscopy (NMR), the latter with the additional requirement of persistent mode operation. Large dipoles for accelerators with fields ($B \geq 8T$) have been successfully built or are under construction, as well as prototype magnets for levitation and flywheels, as well as for future fusion reactors.

Specific magnet problems will be briefly discussed.

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