Research of superconducting materials and devices at the Instititute of Electrical Engineering, SAS, Bratislava

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In the field of superconductor science and technology our effort is focused on study and development of materials and devices for application in electric power.

The superconducting materials are prepared at the Institute in short samples with the aim to investigate the best procedure for industrial production. These efforts recently focused on the multi-core MgB_2 (critical temperature ~38 K) in composite metallic matrix. Currently the in-situ route allowing a doping of superconducting cores with additives improving the capacity of electric transport is favored. The goal is finding a feasible technology of wires suitable for AC applications, i.e. with cores of diameter < 20 mm, twisted with the pitch ~10 mm and enclosed in metallic matrix with high thermal conductivity but reduced electrical conductivity. Copper with additions of metallic oxide (glidecop) seems at the moment to be the best choice for this purpose.

Extensive efforts are dedicated to the development and investigation of electric power devices using the 2nd generation of high-temperature superconducting tapes cooled by liquid nitrogen. Commercially available tapes are characterized in detail in order to optimize the design of superconducting magnets, cables, fault current limiters. Experimental methods have been developed to study tiny dissipation at AC transport or at the application of AC magnetic field (AC loss) or under the combination of both of them. Small coils that could serve as models for motor or transformer windings have been manufactured and tested. Part of the activity aims at the development of concepts of conductor cabling that is necessary for such applications as transformers or tokamak magnets.

In this research of materials and devices the use of numerical models is of big importance. The Institute is worldwide recognized as one of the leaders in the development of dedicated numerical methods for the calculation of magnetic field interaction with hard superconductors.