Abstract of Presentation

High pressure processed, MgB_2, ReBCO and Pnictide bulk materials for applications and fundamental studies

Abstract :

MgB_2, ReBCO, and Pnictide high temperature superconductors show limited sample performance and transport current carrying capability from several reasons. These are in particular weak grain connection, phase purity, strong flux pinning centres and the phase densification and grain connectivity. Applying high pressures during synthesis or oxygenation, the unique expertise of the Institute of Superhard Materials of the National Academy of Sciences of Ukraine (ISM NASU), is a powerful tool to study the sample improvement due to high densification and creation of dispersed nanostructural defects (and/or inclusions) which can act as pinning centres, a goal to be realized in wires and tape conductors too. The work of the past shows that investigation of dense bulk materials provides a much deeper insight into the mechanisms which influence the superconducting behaviour and improve the transport currents and that improved preparation techniques can be transferred to wire and tape fabrication with success. Already HTS bulk applications as levitation bearings applied in Maglev systems, FCL and rotating machinery profit significantly from processing under high pressures. New application fields as space applications and bulk magnets are of interest.

In an EU-Japan consortium, particular central key topics of interest are:

- Grain connectivity in MgB_2 after high pressures can profit from a perfect densification and phase formation mechanisms under these conditions.
- Phase diagram studies in dense bulk using improved precursor materials
- Processing and analysis of homogeneous and new pinning sites
- Texture effects and anisotropy of HTS in extreme dense conditions.
- Processing large bulk pieces for application tests.
- Enhanced trapped field in bulk materials increasing application
- Application relevant bulk materials for levitation, bulk magnets and FCL

The available equipment allows to apply

- - 30 MPa up to 2200 ^{o}C (hot pressuring) for samples up to 200 mm in diameter,
- - 2 GPa pressure and up to 1400 ^{o}C , (using recessed anvil type high pressure apparatuses HPA) samples up to 62 mm diameter. HPA for 150 mm blocks under the construction
- - up to 7.7 GPa pressure and 1800 °C for 100 h for samples 9 mm in diameter.
- - 50-96 MPa (spark plasma sintering (SPS)) for samples up to 80 mm diameter
- - 16 MPa isocratic oxygen pressure with heating up to 800 ^{o}C