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Master- and PhD Thesis at Campus Nord **Research and Development on HTS Coated Conductors with KC4 line**

In recent years, high temperature superconductors (HTS) have been developed intensively for different applications (high field magnets, fusion magnets, current limiters, etc.). REBCO HTS tapes used for these applications are hybrid materials where the superconductor is thin layer within a multilayered coated conductor structure, and usually it is coated by metals, e.g. by silver, copper, or stainless steel. Performance of a superconducting tape is characterized by many parameters, including critical temperature, critical current I_c in different technological conditions like high magnetic field and low temperatures, interfacial resistance, electro-mechanical properties etc.

KC4 (KIT-CERN Collaboration on Coated Conductors) at ITEP is a unique, open-access HTS coated conductor synthesis laboratory that aims to bridge the gap between small-scale laboratory research on coated conductors and the production of longer tape lengths suitable for specific applications. To produce a high-quality coated conductor with specified properties, numerous parameters must be carefully controlled.

The interfacial resistance between the superconducting layer and the surrounding layers is an important characteristic of an HTS tape, alongside current density and critical temperature. It strongly influences the current transfer length (CTL) and the normal zone propagation (NZP) velocity. The interfacial resistance often differs by orders of magnitude in commercially available HTS tapes. Since the interface resistance is the resistance between the superconducting layer and the first metallic layer deposited on the superconducting material, the value of the interface resistance should be affected by the deposition method, the handling of the tape before depositing silver, and the quality of the silver layer.

For the tapes produced by KC4 different methods relying on different silver deposition parameters and/or on the use of different silver alloys can be employed for understanding the systematic influence of the deposition method and other parameters on the value of interface resistance.

For high field applications the electromechanical performance of HTS tapes is crucial. Among the dependence of I_c from tensile and compression loads, delamination strength of the tape is an important parameter that might limit the applicability of HTS tape for high field magnets, since the forces in coils acting on tapes are quite large. It is known that the electromechanical properties of HTS tapes vary significantly between manufacturers and even between different batches from the same manufacturer. Understanding the factors responsible for electromechanical performance, and especially delamination strength would allow improving the electromechanical performance of the tapes and make them suitable for high field applications.

We are proposing several topics suitable for bachelor's, master's, and PhD theses:

1. Systematic production and characterization of KC4 HTS tapes with different artificial pinning centres for application in high magnetic fields
2. Characterization of the electro-mechanical properties of KC4 tapes and exploration of methods for enhancing their performance
3. Investigation of production parameters influencing the interfacial resistance and current transfer length.

The work will take place at Campus Nord. An office/workspace will be provided.

Please feel free to contact us — depending on your individual interests, we will find a suitable topic for your master's or PhD thesis!

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