Mechanical Stability of HTS CroCos and Structural Material Boundaries

Klaus-Peter Weiss*, Nadezda Bagrets, Walter H. Fietz, Reinhard Heller, Jan Sas, Thomas Vogel, and Michael J. Wolf

Karlsruhe Institute of Technology, PO Box 3640, 76021 Karlsruhe, Germany

**Corresponding author: klaus.weiss@kit.edu*

During the past years, all engineering fields developing fusion technology were pushed to the limits to allow building devices like ITER or W7-X. Now as the production of components for ITER is on-going, solutions for the next generation of fusion reactors are in the focus. Especially the cryogenic components of the superconducting magnets are crucial, as they are exerted to Lorentz forces at operating magnetic field of more than 12 T.

The superconducting cable is a key component that has to be examined under such conditions to ensure a safe operation of the magnets. Beside of using established low temperature Nb_3Sn or NbTi superconducting wires to design high current cables, the high temperature superconductor (HTS) REBCO coated conductor is a possible candidate to build such cables and the general feasibility of a HTS toroidal field coil for future fusion magnets was studied recently [1].

In this work the performance of an assembled soldered stack of coated conductors, the so-called HTS CrossConductor (HTS CroCo) [2], is investigated under mechanical loading in axial and transversal direction at cryogenic temperatures. The possible scaling from the mechanical behavior of single coated conductors to the stacked HTS CroCo is considered.

The Lorentz forces that are generated by the superconducting cables of a winding pack need to be balanced by the structural material within a coil. Therefore, the overall mechanical parameters of the jacket, insulation and casing material define boundaries to the magnet design in addition to the performance of the superconducting cable and are highlighted in this work.

[1] R. Heller *et al., IEEE TAS* **26** (4) (2016), 4201105
[2] M. J. Wolf, et al., IEEE TAS 26 (2), 6400106, (2016)