



**MT 26**  
**International Conference**  
**on Magnet Technology**  
Vancouver, Canada | 2019

Contribution ID: 843

Type: **Poster Presentation**

## **Tue-Mo-Po2.10-01 [73]: Structural Modelling of HTS Cable-in-Conduit Conductor with Helically Slotted Aluminum Core for High-Field Magnet Applications**

*Tuesday 24 September 2019 08:45 (2 hours)*

A structural model has been developed for the Cable-in-Conduit Conductor (CICC) made with 2G HTS superconductors inserted in a helically slotted aluminum core (concept proposed by the ENEA Superconductivity laboratory [1]). The cable is particularly suited for high-field applications and consists of a twisted aluminum core and five helical slots. Each slot accommodates a stack of twenty REBCO tapes. The cable is equipped with a central cooling channel and an aluminum jacket.

In this work, finite element analysis is used to predict the electrical performance of the cable as function of the bending diameter. Modelling results are compared with experimental results obtained at 77 K. The experiments were carried out to investigate the smallest bending diameter achievable without critical current degradation. This aspect is particularly important for a magnet design, as the cable needs to be bent to form the desired coil's shape.

The model consists of three parts: compaction of the aluminum jacket on the slotted core (each slot filled with the HTS stack of tapes), cable's bending and thermal cooldown (from room temperature to 77 K). The electrical performance is then calculated from the obtained strain distribution of the stack taking into account the axial strain dependence of the critical current measured on single tape. Once the model is validated using the experimental results available, an alternative CICC cable, made with a copper core will also be evaluated numerically to highlight the effect of the core material properties (thermal and mechanical) on the strain distribution of the tapes after bending.

The numerical modeling will provide important information on the strain state of the tape-stacks and can be used to investigate the behavior of the more recently developed 6-slots cable and optimize future configurations.

[1] G. Celentano et al "Bending Behavior of HTS Stacked Tapes in A Cable-In-Conduit Conductor With Twisted Al slotted Core,"IEEE Trans. Appl. Supercond., accepted for publication

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**Session Classification:** Tue-Mo-Po2.10 - REBCO Wires & Cables II