

# Flexibility and contact resistance of CORC® cables and wires: Experiments and modeling

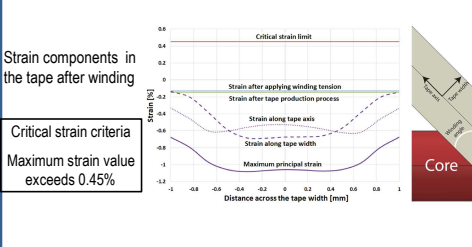
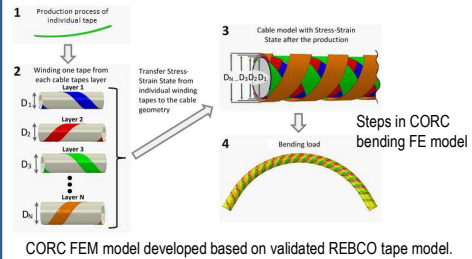
V.A. Anvar<sup>1,2</sup>, K. Wang<sup>1,3</sup>, M.S.A. Hossain<sup>2,4</sup>, J.D. Weiss<sup>5</sup>, D.C. van der Laan<sup>5</sup>, A. Nijhuis<sup>1</sup>

<sup>1</sup>The University of Twente, Faculty of Science & Technology, 7522 NB Enschede, the Netherlands, <sup>2</sup>Institute for Superconducting and Electronic Materials, University of Wollongong, Wollongong, Australia, <sup>3</sup>College of Civil Engineering and Mechanics, Lanzhou University, 730000 Lanzhou, China, <sup>4</sup>School of Mechanical and Mining Engineering, The University of Queensland, Brisbane, QLD 4072, Australia, <sup>5</sup>Advanced Conductor Technologies and University of Colorado, Boulder CO 80301, USA.

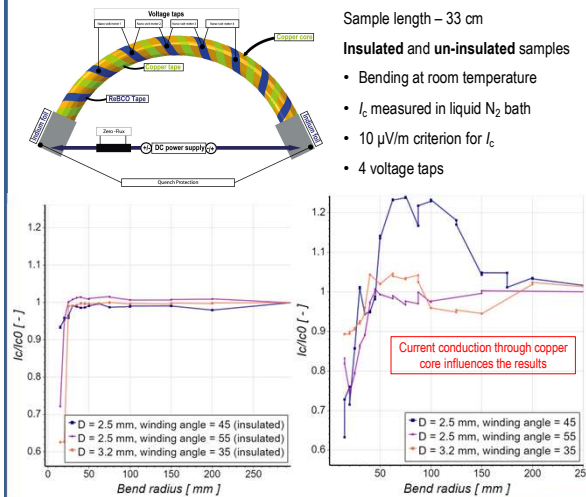
## Abstract

HTS Conductor on Round Core (CORC®) cabling concept allows cables to be manufactured with round formers as small as two to five millimetres in diameter. CORC® consist of several layers of helical tapes wound around a central metallic core in an alternating fashion. A detailed Finite Element modeling of REBCO tape strain state is done to analyze mechanical behavior CORC cables and wires supported by experiments. Current sharing of REBCO tapes through the copper core is investigated with a simple electrical network model and experiments. Also, another electrical network model is created to study the effects of degraded spots in the tape and visualize the strained tape's mechanical flow.

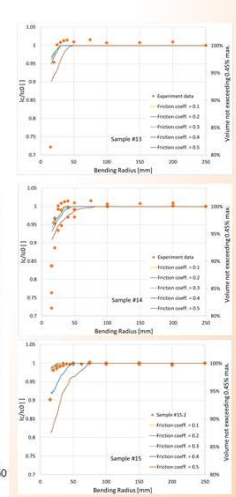
## CORC FEM modeling



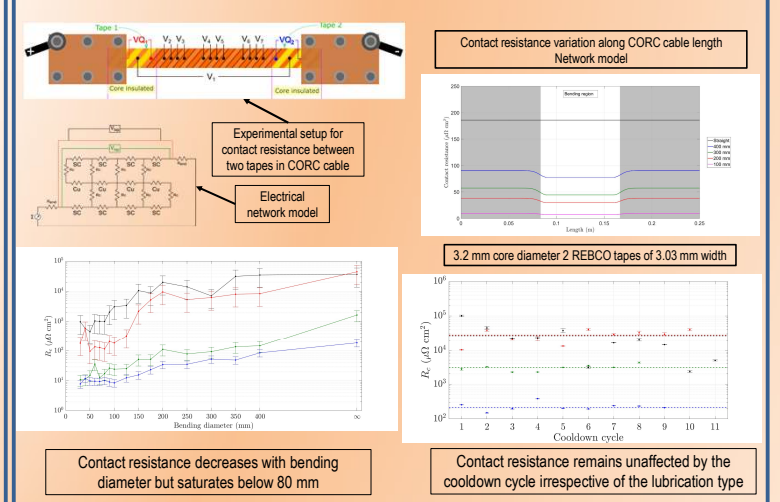
## CORC bending experiments



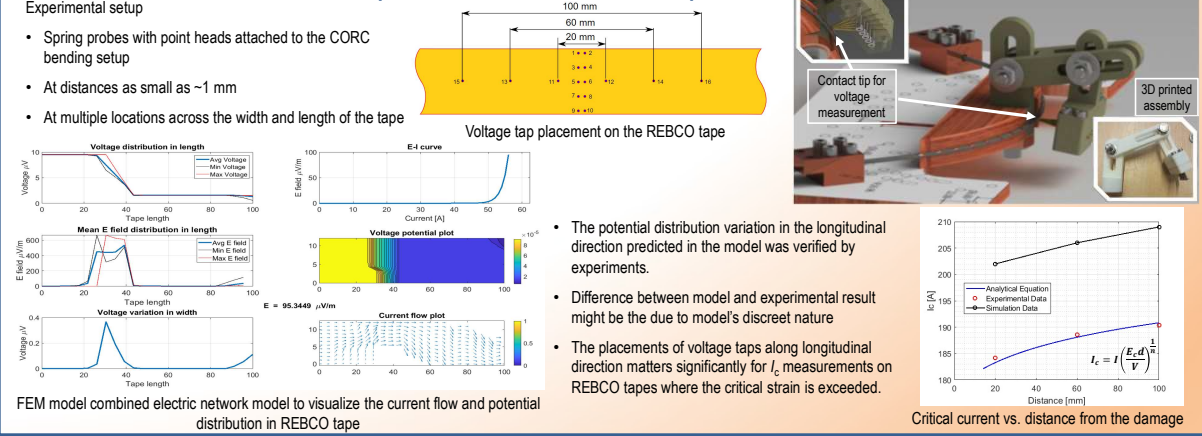
## FEM comparison



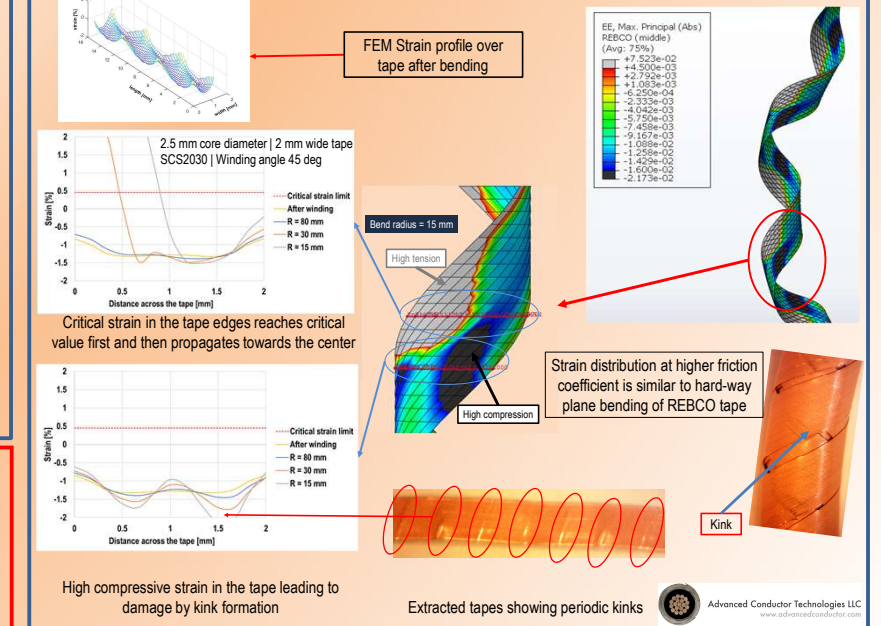
## CORC contact resistance experiments and modeling



## Local potential distribution in REBCO tapes



## Tape strain in CORC bending



## Conclusions

- A detailed CORC® FE model is built, and a first validation is done based on experimental data reaching qualitative agreement.
- Mode of failure in CORC cable is by combination of tensile strain damage and kinking, similar to hard-way bending of REBCO tapes.
- Contact resistance between tapes reduces with CORC bending and saturates below 80 mm bend diameter.
- Electrical network model can be used to visualize the current flow and potential distribution in CORC cable under mechanical loads.
- Placement of voltage taps in experiments matters significantly in case of local damage, a 10%  $I_c$  variation can be observed at ~50 cm away from the local damage.