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

Contribution ID: **1354** Type: **Contributed Oral Presentation**

# Tue-Mo-Or8-04: Hoop stress concentration in an HTS tape coil under external magnetic fields

*Tuesday, 24 September 2019 11:30 (15 minutes)*

The use of REBCO inner coils is a promising option for developing high-field magnets since the coil can be designed at high-hoop stress typically at >400 MPa. Such a coil, however, sometimes suffers from the appearance of a normal voltage even at medium hoop stress such as 200 MPa, i.e., unexpected degradation [1]. We believe that those degradations are caused by strong electromagnetic forces in high magnetic fields. REBCO conductors are very weak against stress concentration modes caused by electromagnetic forces, such as cleavage/peeling (Mode #1), buckling (Mode #2), and axial tensile stress under edgewise bending (Mode #3). In a previous paper [1], we predicted a degradation due to hoop stress concentration in Mode #3 caused by screening currents. In fact, recently, effects of screening current-induced stress [2] have been reported both experimentally [2] and numerically [3].
In the present work, we investigated the effect of conductor thickness on hoop stress concentration using structural analysis for a current transport one-turn tape coil under an external field, in which coil Lorentz force originated from the screening current is considered. It gave a hoop stress distribution in the superconducting layer, which results in Mode #3 stress concentration. We obtained the maximum circumferential stress, σ<sub>max</sub>, and compared it to the ideal hoop stress, BJR. We found that the stress concentration factor, defined by σ<sub>max</sub>/BJR, drastically depends on the geometry of the tape conductor. This result is of great importance for conductor selection for the design of a high-field HTS inner coil.
[1] Kajita et al. SuST 30 (2017) 074002
[2] Hahn et al. Presented at ASC2018 (2018) 4LOr3B-01
[3] Ueda et al. Presented at 97th Ann. Conf. Cryo. Soc. Japan (2018) 3C-a09
This work was supported by the JST Mirai-Program Grant Number JPMJMI17A2.

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**Session Classification:** Tue-Mo-Or8 - High Tc Wires and Cables I