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

Contribution ID: **751** Type: **Contributed Oral Presentation**

Tue-Mo-Or8-05: Effect of thermal mismatch stress and electromagnetic loads on delamination in REBCO coated conductors

Tuesday 24 September 2019 11:45 (15 minutes)

Rare Earth-Barium-Copper-Oxide (REBCO) coated conductor (CC) tapes are promising conductors for high energy and high field applications. In the case of epoxy-impregnated REBCO superconducting coils, however, excessive transverse stresses generated from cooling, and Lorentz forces on the CC tapes can cause delamination, resulting in reductions in the load-carrying capacity as well as significant degradation in the coil' s critical current. In this study, a simplified representative element of REBCO CC coils is used to qualitatively study the influence of thermal mismatch stress and electromagnetic force on delamination in REBCO coated conductor by finite element model. First, a 2D REBCO CC delamination model based on the cohesive zone model (CZM) is constructed. All the adjacent layers are coupled via spring equations under the CZM framework to character the interfacial failure due to delamination. The basic delamination properties such as deformation of each constituent layer, interfacial stiffness and interfacial traction varying with transverse mechanical load are presented. Furthermore, the thermal and electromagnetic loads influence on delamination behaviors are intensively discussed. The results show that the CZM defined on the interfaces have strong influence on stresses/strains distributions in each constituent layer even through no delamination occurs. As the electromagnetic force are generated in REBCO layer, both the stresses/strains distributions and delamination behaviors are significantly influenced by the magnitude and direction of the electromagnetic force. Thermal mismatch stress generated during cooling process in a large temperature range also has the possibility to lead to delamination in REBCO CC. The insulation's characters, such as thickness, elasticity modulus, coefficient of thermal expansion, prestress of the insulation, are all strong effect the delamination behaviors of REBCO CC. Additionally, the occurrence of delamination on the interface between insulation and CC tape can effectively prevent of delamination of REBCO CC tapes. The FEM analysis provides an effective method to investigate thermal stress and electromagnetic force influence on delamination behaviors of REBCO CC, which is helpful for REBCO CC application in cryogenic temperature and electromagnetic field.

Authors: Dr GAO, Peifeng (Lanzhou University); Mr DUAN, Hao (Lanzhou University); Prof. WANG, Xingzhe (Lanzhou University); Prof. ZHOU, Youhe (Lanzhou University)

Presenters: Dr GAO, Peifeng (Lanzhou University); Prof. WANG, Xingzhe (Lanzhou University)

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