Contribution ID: **70** Type: **Poster**

Fri-Mo-Po.01-04: Reduced screening-current-induced stress in NI-REBCO coils by actively degrading the critical current of REBCO tape through heat treatment

Friday 4 July 2025 09:30 (1h 45m)

No-insulation REBCO (NI-REBCO) coils, with self-protecting capabilities during quench, have attracted significant interest and shown considerable potential for high-field applications. As research advances, it has become increasingly evident that uneven stress/strain induced by screening currents is a critical factor affecting the performance of NI-REBCO coils. Therefore, reducing screening-current-induced stress/strain is vital for the effective mechanical design and stable operation of NI-REBCO coils and magnets. Our numerical simulations indicate that the critical current of coils located at the two ends of the NI-REBCO magnet is lower than that of the coils at the center, primarily due to the influence of the perpendicular magnetic field. Since the coils are connected in series, the transport current is limited by the lowest critical current, resulting in the critical current of the central coils being significantly higher than required. Our results also reveal that screening-current-induced stress is strongly correlated with the critical current of the REBCO tape. Consequently, for coils where the critical current significantly exceeds the demand, reducing the critical current to mitigate screening-current-induced stress is an effective strategy. Building on these numerical findings, we conducted experimental investigations by fabricating a set of coils with 10 turns REBCO tape and applying heat treatment to reduce their critical current. These coils were then tested in a 20 T, 200 mm bore, water-cooled magnet to observe the variation in hoop strain as the background magnetic field was varied. The experimental results confirmed that reducing the critical current of the REBCO coils effectively mitigates screening-current-induced stress. However, certain heat treatment parameters (temperature and duration) were found to adversely affect the mechanical properties of the tape. This underscores the importance of balancing stress reduction with the preservation of the tape's mechanical integrity. Future research should focus on optimizing heat treatment conditions or exploring alternative methods to reduce the critical current without compromising the material's mechanical properties.

Author: JIANG, Zhaofei (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences)

Co-authors: WU, Xiangyang (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences); QIAN, Xinxing (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences); FANG, Zhen (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences)

Presenters: QIAN, Xinxing (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences); JIANG, Zhaofei (High Magnetic Field Laboratory, Hefei Institutes of Physical Science, Chinese Academy of Sciences)

Session Classification: Fri-Mo-Po.01 - No-Insulation Coils IV