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Wed-Af-Po3.24-08 [102]: Reliability evaluation procedure of REBCO coated conductor tapes based on mechanical and electro-mechanical properties obtained by uniaxial tension and cyclic tests at 77 K

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In the HTS superconducting magnet application fields like motors, generators and SMES, 2G coated conductor (CC) tapes will be subjected to alternating stress or strain during manufacturing and operation. The repeated load affects the mechanical integrity and eventually the electrical transport property of CC tapes. In the design of coils and magnets under magnetic fields, both the yield strength obtained by a quasi-static uniaxial tensile test under the use environment (temperature and magnetic field) of 2G CC tapes and the irreversible stress limit obtained by the electromechanical property evaluation test considering the Ic degradation behavior have been mainly used. Selection of 2G CC tapes for superconducting coils is usually based on these values. On the other hand, considering the operating life of superconducting coils and magnets such as 30 years, the fatigue life will be 105˜106 cycles. Based on this condition, the mechanical fatigue limit from the S-N curves obtained by the high cycle fatigue test of CC tapes will be determined. Meanwhile, it is necessary to carry out the electromechanical characteristic fatigue test to evaluate the Ic degradation behavior induced by the repetition of a specified stress amplitude expected during operation. This makes it possible to determine the electromechanical fatigue limit of the CC tapes. The establishment of mechanical and electromechanical properties through a series of uniaxial tensile and fatigue tests is necessary to evaluate the reliability of CC tapes and to ensure the durability of the application devices. In this study, we introduce the procedure for evaluating reliability of 2G CC tapes using characteristic limit values obtained through a series of mechanical and electromechanical properties evaluation tests.
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Authors: SHIN, Hyung-Seop (Andong National University); Dr DE LEON, Michael (Andong National University); Mr DIAZ, Mark Angelo (Andong National University)

Presenter: SHIN, Hyung-Seop (Andong National University)

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