

Establishment of test procedures on the electromechanical property of practical REBCO CC tapes under uniaxial tension loading for standardization

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Abstract

Nowadays, the superior electric and mechanical properties of 2nd generation practical coated conductor (CC) tapes made them a viable option for various device applications such power cables, magnets and coils. CC tapes are composite conductors which are consisted of a superconducting layer and some functional component layers of substrate, buffer, protection and stabilizer. The constituent layers directly affect the mechanical and the electromechanical properties of the superconducting layer under operating conditions. It is therefore indispensable to investigate the strain effect on the critical current (I_c) and to determine the irreversible limits of CC tapes for magnet and coil application. In order to commercialize globally CC wires, there is a great demand for the establishment of the IS of the test method. However, there is no an international standard (IS) or code for testing the electro-mechanical properties of high-temperature superconductors. Therefore, it is necessary to establish a useful criterion for the electromechanical properties of 2G CC in the engineering aspect. In this study, as an activity of standardization, the strain/stress sensitivity of I_c and the reversible strain/stress limits for I_c degradation of practical CC tapes with different configurations under uniaxial tension were evaluated at 77 K and self-field. The reversible strain limits of in CC tapes were defined and compared using different criteria regarding the reversible recovery of I_c during loading-unloading, which are based on the 99% $I_c(\epsilon)$ recovery and the 99% I_{c0} recovery, respectively. The results showed that the criteria of 99% $I_c(\epsilon)$ recovery gave a higher limit value when compared to the criteria of 99% I_{c0} recovery in terms of strain limit. However in terms of stress limit, it gives almost similar value for both criteria. Both criteria give the idea where should be considered in defining their electromechanical properties, especially the limit of reversible recovery of I_c . Also practical CC tapes supplied from different manufacturers indicated some different electromechanical properties depending on the processes and the configuration adopted. Finally, the 99% $I_c(\epsilon)$ recovery criteria showed much higher reversible strain limit so that the CC tape will be reversible recovery of I_c until higher tensile strain state, not on the I_{c0} .

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