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M1Po2B-01 [31]: Critical Current Measurments of Comercial REBCO Tapes as Function of Strain, Temperature and Magnetic Field

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Next generation fusion and high energy physics machines will require high field magnets with the ability to operate at variable temperatures. Therefore, high current cables able to operate in such conditions will be required. As reaching magnetic fields higher than 16 T using traditional Low Temperature Superconductors can be challenging, the more recently investigated High Temperature Superconductors, and in particular REBCO conductors, could satisfy such requirements. While different configurations of high current REBCO cables are under developement, it remains crucial to understand the intrinsic behavior of individual tapes in order to optimize the cables design.
In our previous work, a technique was developed to measure the strain dependence of the critical current of REBCO tapes at different temperatures (from 4.2 to 40 K) and high magnetic fields (12-15 T). The measurements were conducted for SuperPower tapes (with 30 m substrate) using a U-spring bending device.
In this work, a new testing setup is presented. The new setup allows us to improve the quality of our measurements especially in addressing current sharing issues that were experienced in the past. The effect of the tape' s composite structure is also investigated by comparing results from tapes with different substrate thickness (50 m and 30 m) and copper stabilizer (40 m and 10 m). Additionally, tapes from different manufacturers are tested at 4.2 K and 15 T and the electrical performance as a function of strain is compared. Finally, the bending mechanism experienced by the tape mounted on the U-spring is modelled with finite element. The numerical analsys is performed to obtain the stress in the REBCO layer corresponding at each applied strain step, and ultimately extrapolate the stress dependence of the critical current of REBCO tapes (by combining the Ic vs strain behavior obtained experimentaly with the stress vs applied strain curve obtained from the model).

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