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Thu-Mo-Po.06-03: Optimization of partial surface friction in GdBCO tapes for mitigating Lorentz force-induced stress in high-field magnets

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When designing magnets with strong magnetic fields, it is imperative to consider the mechanical stress induced by the Lorentz force. However, conventional stress-strain calculation methodologies, or force balance equations that utilize the BJR formula, often neglect the frictional force between superconductor tapes. This motivated our previous study on the relationship between the frictional force on the surface of the superconducting tape and the deformation of the coil. These results confirmed that the friction coefficient on the surface of the superconducting tape is related to the stress-strain experienced by the coil. In the present study, the effect of the friction area on the coil was investigated by optimizing the frictional force by fabricating GdBCO tape of which part of the surface has a deliberately designed friction coefficient. The mechanical stress on the magnet wound with the intentionally roughened GdBCO tape was examined by simulating the occurrence of the Lorentz force. The experimental results will be discussed in detail, with particular reference to the deformation of the coil and the optimization of the friction area.

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