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Design of a Bifilar HTS Switching Element Using Iron-Core Field Coils

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The self-field critical current Ic of 2G high temperature superconducting (HTS) tape can be reduced by applied dc magnetic field. This property can be used in the development of HTS switching elements through so-called Jc(B) switching. The design of a dc magnetic field switch is reported with both single and bifilar configurations. Dc magnetic field is applied by an iron-core field coil with copper windings, providing an applied field of up to 1.4 T. This allows for effective suppression of Ic. Here, it is also reported that the self-field Ic of the single tape is suppressed from 377 A to 195A in the presence of the iron-core. This is due to the presence of the iron core amplifying and distorting the self-field of the tape and is confirmed by experiment and finite-element modelling. This effect can be eliminated using a bifilar tape configuration, which recovered close to the no-core self-field Ic. Active dc switching by applied field was still achieved in the bifilar configuration, albeit at reduced efficacy due to screening. Such distortion and suppression may prove useful for the development of novel HTS circuit components.

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