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Predicting the behavior of insulated REBCO coils up to their operation limit to identify safe operation domain

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The development of compact REBCO HTS coils (Rare-EarthBiCaCuO High Temperature Superconductor) with large energy densities face two issues. The first is destructive thermal runaway induced by local dissipative zones, the second is dynamic field homogeneity. The first issue, thermal runaway, may be solved by using a non-insulation or partial insulation technique. These techniques however affect negatively the second issue, as induced current loops may appear both in the tape surface and across coil turns. We observed, as other groups, that an early detection of dissipating voltages makes it possible to discharge isolated coils before a dangerous thermal runaway can occur. However, the dissipating voltage that must be detected is very low, comparable in amplitude to the transient voltage due to magneto-electric effects. Both phenomena must thus be modelled so that their effects can be discriminated in the detection scheme. The combination of both electromagnetic and electro -thermal transient modelling makes it possible to define safe operation scenarios to determine the operation domain of REBCO coils.

Topic

Applications in large instruments such as high-field magnets, medical magnets and accelerator magnets

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