Contribution ID: **1478** Contribution code: **WEPM070** Type: **Poster Presentation**

Investigations on NbTi superconducting racetrack coils under pulsed-current excitations

Wednesday, 10 May 2023 16:30 (2 hours)

One of the key issues in the technology of superconductors is the protection against quenches. When designing a superconductor as a magnet, a coil or even current leads, the design should be made such that the superconductor withstands all operational conditions as fast discharges, pulsed loads or even rapid transient background fields.
Computational modeling of pulsed-current characterization in a self-field NbTi racetrack sample coil has been performed using the finite element modelling software Opera as a step towards understanding the thermal and electromagnetic processes during a quench. The pulse was modelled to be generated by discharging a capacitor into an RLC circuit, which includes the NbTi racetrack coil as the sample under test. The coil was driven to the resistive state and the quench occurred by applying the pulse with a peak value exceeding the critical current of the sample coil.
This contribution presents the results obtained from investigating a pulsed NbTi coil in a model based on an electromagnetic analysis. In addition, a comparison to the theoretical expectations derived for the damped oscillations in the pulse-driving circuit is given. Finally, the results from a coupled analysis, where both thermal and electromagnetic properties are being considered, within a quench multi-physics study are presented.

Funding Agency

Footnotes

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Session Classification: Wednesday Poster Session

Track Classification: MC7: Accelerator Technology and Sustainability: MC7.T10: Superconducting Magnets