Abstract

The latest observations from results of comprehensive computer simulation of the NHMFL 32T all-superconducting magnet quench tests

National High Magnetic Field Laboratory, Florida State University, Tallahassee, Florida, USA

The 32T all-superconducting user magnet comprised of a 17T REBCO tape pancake-wound two-nested-coil insert and a 1ST LTS multi-coil outsert custom-made by Oxford Instruments, Inc. is now being quench-tested at the NHMFL. The magnet protected-quench behavior was simulated beforehand using a custom-written Fortran computer code. The predictions were used to plan the tests: they enable us to preset safer levels of transport currents and fields to start with and then to gradually complicate the test scenarios responsibly. All thinkable scenarios of the quench tests were simulated and analyzed carefully in detail. The simulation results have not been compared with the measurements in the insert coils yet. As of now, the first measured data are just being processed.

The model

Typical hot-spot temperature evolution in the event of a quench due to a local, point defect. Current is fixed (quench detection failure).

The magnet is at full field. Outsert quenches and its protection system is promptly triggered (fast discharge mode). The insert heaters must be fired, too. What will happen if the insert heaters are not fired and if fired promptly as it should be?

A test to start with: insert alone (outsert is idle), relatively low field (stored energy); insert all heaters are deliberately fired simultaneously

| The magnet key parameters: |
| Clear bore | 34 mm |
| Stored energy | 8.3 MJ |
| Operating temp. | 4.2 K |
| Center field | 32 T |

15 T / 250 mm bore LTS magnet (outsert), REBCO tapes by SuperPower, Inc.
17 T / 34 mm bore REBCO coils (insert, module/double pancake construction), REBCO tapes by Oxford Instruments, Inc.

Distributed quench protection heaters between the modules; a – line loss.

Do voltages acceptable?

Mon-Af-Po1.10

The magnet and its quench protection system

Simulated beforehand using a custom-written Fortran computer code. The predictions were used to plan the tests: they enable us to preset safer levels of transport currents and fields to start with and then to gradually complicate the test scenarios responsibly. All thinkable scenarios of the quench tests were simulated and analyzed carefully in detail. The simulation results have not been compared with the measurements in the insert coils yet. As of now, the first measured data are just being processed.

The latest observations from results of comprehensive computer simulation of the NHMFL 32T all-superconducting magnet quench tests

National High Magnetic Field Laboratory, Florida State University, Tallahassee, Florida, USA

The 32T all-superconducting user magnet comprised of a 17T REBCO tape pancake-wound two-nested-coil insert and a 1ST LTS multi-coil outsert custom-made by Oxford Instruments, Inc. is now being quench-tested at the NHMFL. The magnet protected-quench behavior was simulated beforehand using a custom-written Fortran computer code. The predictions were used to plan the tests: they enable us to preset safer levels of transport currents and fields to start with and then to gradually complicate the test scenarios responsibly. All thinkable scenarios of the quench tests were simulated and analyzed carefully in detail. The simulation results have not been compared with the measurements in the insert coils yet. As of now, the first measured data are just being processed.