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Tue-Mo-Po2.10-03 [75]: Relevance of current density in copper stabilizer for quench protection of coated conductors

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Material scientists have been leading the R&D of coated conductors, and they have been focusing on increasing critical currents and lengths of coated conductors. Thanks to their efforts, long coated conductors with large critical currents are commercially available now. However, when we look back over the history of R&D of low Tc superconductors, stabilization using copper was a breakthrough to their practical applications. The amount of copper, i.e. the current density in copper stabilizer, is one of the critical factors for their stabilization and quench protection. It must be same in coated conductors, and the effect of copper stabilizer in coated conductors has been studied by various authors, but their approaches were mostly theoretical. The objective of this study is reminding of the relevance of current density in copper stabilizer for quench protection of coated conductors by using a well-organized set of experimental data.
We carried out experiments using short pieces of coated conductors in order to simulate the initiation phase of quench of a magnet. Slow normal zone propagations in coated conductors allow us such simulating experiments. We conduction-cooled 180 mm-long coated conductor samples, and initiated quenches using small resistive heaters. An FPGA module enabled us monitoring the sample voltage and controlling the output current of a power supply. Once the monitored sample voltage reached a threshold value (simulating a quench detection in a magnet), the output current of the power supply was decreased exponentially (simulating the decay of the magnet current by a dump resistor). Series of experiments were done using coated conductors with 20 micron-thick plated copper and those with 40 micron-thick plated copper, and the conditions for successful quench protection were compared.

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