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Experimental investigation of switching to normal state of CC-tapes under the action of magnetic field pulses

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In this work, we studied the behavior of CC-tapes under the action of magnetic field pulses: a transition to a normal state was observed in case of application of external magnetic field pulses to tapes loaded with transport current. The data obtained allow us to solve the problems associated with the development of high-speed switching devices based on high-temperature superconductors designed for operation in superconducting energy storage devices, energy distribution and transmission systems, current limiters, and new types of modern transport.

In this work, experimental studies of the behavior of CC-tapes under the action of pulses of an external magnetic field were carried out. The studies were carried out on samples of 4 mm wide CC-tapes manufactured by SuperOx. To reduce the value of transport critical current of the tape, bridges of various widths were made by laser cutting. During the experiment, a transport current of various values was applied to the superconducting bridge. The transport current values were close in value to the critical current of the bridge. After that, a magnetic field pulses were applied parallel to the tape plane. The influence of such parameters as the value of the initial transport current, the amplitude and duration of the magnetic field pulse on the transition of the CC-tapes to the normal state and the return to the initial superconducting state was studied. The measurements were carried out both in liquid nitrogen and during cooling using a cryocooler. The effect of temperature on the transition to a normal state was studied in the range of 30 to 80 K.

At certain pulse parameters, damage to the superconducting layer of CC-tapes was observed. The distribution of the damaged zone was observed, and the degradation of the superconducting properties of CC-tapes was assessed by studying the samples using Hall magnetometry and magnetooptics.

The analysis of experimental data and the conclusions of this work can be useful for practical application in the development of high-speed switching devices based on CC-tapes.

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