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MATHEMATICAL MODELING OF THE SPREAD OF THE NORMAL PHASE IN HIGH - TEMPERATURE SUPERCONDUCTORS *)

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Modern physical attitudes of controlled thermonuclear synthesis, as well as accelerating systems, are largely based on the use of "cold" windings to create a strong magnetic field. Such coils made of superconducting materials, and, in particular, from their high -temperature modifications, are the basis of devices that ensure the creation of a magnetic field in thermonuclear synthesis systems (ITER) or in accelerating systems (LHC). The reliability of such systems directly depends on the materials used and the quality of the manufacture of superconducting cables. Violation of the conditions for the transportation of current (exceeding the critical values of the current, magnetic field or temperature) entails in such a section of the cable the cessation of the superconducting mode and the occurrence of the normal, ohmic phase of the passage of current. In this case, the released heat can lead to the combustion of this part of the cable and the failure of the entire system. In this work, the regimes of this “emergency” transition of the superconducting state of the conductor to normal are numerically analyzed. A mathematical model for describing such a process is proposed. In almost important cases, the temperature grows in these cases in the mode with exacerbation. The question is fundamental - under what parameters and properties of materials this regime will be accompanied by localization of heat (then this will lead to the destruction of the conductor), and at which the normal phase will spread along the length of the conductor, without leading to a critical increase in temperature.

*) abstracts of this report in Russian