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Mon-Mo-Po1.01-11 [10]: Experimental study on quench protection of HTS magnet composed of multiple pancake-coils by use of auxiliary resistive shunt loop method

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HTS coils wound with insulated wires are actually quenched, even though HTS wires have a high quench margin and can be easily damaged, if the quench protection system does not work properly, especially in the case that current density of the magnet wires is high, It should be noted that the training effects as in LTS magnets have not been observed in HTS magnets and that damaged HTS magnets cannot be reused. Therefore, protection of HTS magnets from quench damage is important for their repeated use. The most probable cause of quench damage of HTS magnet is over-heating at the highest temperature spot (hot-spot) in the magnet wire during the quench protection sequence. Therefore, to avoid damage, it is necessary to reduce heat generation in the hot-spot. In a previous work, the authors proposed a quench protection method to reduce hot-spot temperature and increase quench detection voltage to protect an HTS magnet composed of multiple pancake sub-coils from quench damages. In the method, a current of a quenching sub-pancake coil is transferred to the other sub-coils of the magnet forming auxiliary resistive shunt loop (ARSL) by resistively shorting the other sub-coils. In this work quench behaviors of the pancake sub-coils of a model magnet was investigated by simulation experiment using small scale test pancake coils wound of YBCO wire. Current patterns of the sub-pancake coils of a model magnet at a quench event were calculated for the case that ARSL method was applied. In the experiment, the same patterns of currents calculated for the model magnet were applied to the quenching test coils by a controllable current supply. Experimental results show effectiveness of the proposed method.

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