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Increased Quench Energy Threshold in Nb3Sn Strands with High Heat Capacity

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Nb3Sn conductors are prone to quench due to deposition of heat energy from disturbances such as flux jumps and cracking of nearby epoxy, which push the conductor into the normal state. In Nb3Sn magnets, this manifests as training, wherein the magnet can reach a progressively higher current after a succession of quenches. By incorporating substances with a higher heat capacity at cryogenic temperatures, the amount of energy needed to increase temperature and cause a quench can be increased. Here we report on the results from several 36/61-restack experimental tube-type strands made by Hyper Tech, each with different high heat capacity additions mixed into the center region of the Cu matrix. We attached a resistor to a strand and, after applying a constant transport current to the strand at 4.2 K, applied increasing amounts of energy to the resistor until the strand quenched. It is shown that wires with high-heat capacity additions can absorb more energy from a heat pulse before quenching than a control wire with a Cu-only matrix. Magnets made from this wire design should be more resistant to quenching, especially at currents approaching Ic.

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