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# Distributed fiber optic sensing to identify locations of resistive transitions in REBCO conductors and magnets

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High-temperature superconductors such as REBa2Cu3O7-x (REBCO) can generate strong magnetic fields that are promising for applications in particle accelerators and compact fusion reactors. Lawrence Berkeley National Laboratory is developing magnet technology-based multi-tape REBCO cable conductors. Traditionally, voltage taps are installed in superconducting magnets. The voltage signals due to resistive transitions are important to develop magnet technology as they can help pinpoint the factors that limit the magnet performance. The architecture of the multi-tape REBCO cable such as CORC® wires, however, makes it difficult to apply the traditional method to identify the locations of resistive transitions. This difficulty precludes us from understanding and addressing the issues that limit the performance of REBCO conductors and magnets. Taking advantage of the thin and long optical fiber, the magnet community has been investigating the distributed fiber optic sensing (DFOS) to detect quenches in HTS conductors and magnets. In this paper, we demonstrate the feasibility of DFOS by applying Optical Frequency Domain Reflectometry to measure the thermal strain along CORC® wires and magnets with 0.65mm spatial resolution and 10Hz temporal resolution. The optical fiber is co-wound with the CORC® wire which is epoxy-impregnated. During the test, current was increased until resistive transitions occurred in the conductor. The results suggested that with proper heat isolation from the cryogen, DFOS can be used to identify the locations of resistive transitions in CORC® wires and magnets. The results allowed us to understand the causes of resistive transitions in REBCO conductors and magnets and to improve the development technology of REBCO magnets.

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