MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1757** Type: **Invited Oral Presentation**

Thu-Af-Or20-01 [Invited]: Quench detection via Rayleigh backscattering interrogated optical fibers

Thursday 26 September 2019 14:00 (30 minutes)

The application of high temperature superconductors (HTS) for the generation of high magnetic field is still limited by technical issues like quench detection. The recently developed quench detection technique based on Rayleigh backscattering interrogated optical fibers (RIOF) has shown to provide unprecedented levels of detection and advantages over conventional, voltage-based approaches. In RIOF, the optical fiber is a distributed sensing element of temperature and strain. Strengths of the technique include immunity to electromagnetic noise, mm-level spatial resolution, long interrogation length, ease of integration and reduction of instrumentation wiring that goes into the magnet. In this talk, several optical fiber integration pathways will be illustrated, along with experimental results showing embodiments of each fiber integration approach. Integration approaches include fiber co-winding, SMART Conductor and SMART Cable. The RIOF technique is based on the comparison of Rayleigh backscattering signals of a reference and perturbed state. A spectral shift quantifies the mismatch between the two conditions, which depends on temperature and strain changes between the two compared states. All optical fiber integrations were demonstrated to be practical and effective. Results of quench detection experiments include HTS test coils with co-wound optical fibers, both pancake and layer wound, Canted Cosine Theta (CCT) coils with integrated optical fibers (co-wound approach), experiments with SMART (RE)Ba2Cu3O7-x Conductor and experiments with SMART CORC® Cables.
All results show that RIOF is a viable choice for quench detection and that it is able to detect and locate perturbations that are completely undetected via voltage taps. In addition to demonstrating that the system works as a detector of normal zones, the experiments also show the different advantages of the fiber optic system over a conventional, voltage-based one.
The work was funded by the U.S. Department of Energy via an STTR program.

Primary authors: SCURTI, Federico (NCSU); Dr ISHMAEL, Sasha (Lupine Materials and Technology); WANG, Xiaorong (Lawrence Berkeley National Laboratory); WEISS, Jeremy (Advanced Conductor Technologies); VAN DER LAAN, Danko (Advanced Conductor Technologies); PRESTEMON, Soren (LBNL); SCHWARTZ, Justin (NC State University)

Presenter: Dr ISHMAEL, Sasha (Lupine Materials and Technology)

Session Classification: Thu-Af-Or20 - Quench Detection and Protection Systems III