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# Comparison of HTS Quench detection methods based on Spontaneous Raman and Rayleigh Scattering in Optical Fibers

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In high temperature superconducting (HTS) magnet applications, quench detection is very important to protect magnets before burning out. However, due to a very slow quench propagation of HTS wires compared with low temperature superconducting (LTS) ones, conventional quench detection methods are not suitable for HTS magnet: The method is that continuously measure resistive voltages on voltage taps dispersedly distributed within a magnet. Therefore, quench detection and protection are obstacles to application of large HTS magnet systems, and faces significant challenges. In order to detect incipient quenches with sufficient time, optical fiber distributed temperature sensors (DTS) systems with high spatial and temporal resolution which have been applied to several industrial circles such as petroleum pipeline, bridge structure, power cable, etc. are able to obtain all temperature related information at any location within a magnet. Recent researches indicate that DTS systems based on Rayleigh scattering in optical fibers provide several outstanding results in quench detection experiments. Nevertheless, owing to intrinsic physical characteristics of Rayleigh scattering in optical fibers, photosignal is affected by environmental heat and oscillation together so that avoidless errors exist in this quench detection method. In contrast, Stokes and Anti-Stokes shifts from spontaneous Raman scattering are only depend on the changes of optical fiber temperature thus quenches in magnets can be expressly observed. In this paper, two typical DTS systems with different techniques which are respectively based on spontaneous Raman and Rayleigh scattering in optical fibers are applied for HTS quench detection. More detailed comparison results and optical fiber DTS systems introduction will be discussed and presented in this paper.

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