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Thu-Af-Or20-03: Acoustic sensor array for quench detection of CICC superconducting cables

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HTS (High Temperature Superconductor) tapes such as REBCO (Rare Earth Barium Copper Oxide) are very attractive for various industrial applications of magnets and power-cables, especially for high field, high current superconducting magnets. An implementation of a sensitive quench detection for HTS devices is ungenerally desired for a safe operation, since normal zone propagations of a HTS conductor are very slow and the quench detection is difficult compared with other practical superconductors such as NbTi and Nb₃Sn. Recently we have been proposing a unique acoustic quench detection method using tiny sensors distributed in a cooling channel of a superconducting conductor. A linear array of MEMS (micro-electro-mechanical system) microphone chips is installed along the coolant space of a CICC (Cable In-Conduit Conductor) superconducting cable in order to detect a quench and abnormal behavior by monitoring the coolant condition. The sensor array can make possible a fast and sensitive detection of quench location. In this paper the quench detection characteristics of a MEMS acoustic sensor linear-array in a CICC type REBCO superconducting cable made of a Twisted Stacked-Tape Cable (TSTC) will be discussed both experimentally and analytically including electrical and thermal response studies of a sensor array in 77 K gas and liquid nitrogen.

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