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Mon-Mo-Po1.08-09 [95]: AC operation characteristics of conduction-cooled HTS magnet for ADR

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A conduction-cooled HTS magnet is designed and tested to produce AC magnetic field of maximum 4 T for an adiabatic demagnetization refrigerator (ADR). The magnet equipped with extensive copper thermal drains is conductively cooled by a GM cryocooler to approximately 5 K and stably generates alternating magnetic field between 0 and 4 T at 0.2 T/s. The fastest ramping rate that dictates the cycle frequency of continuous ADR, is to be determined by the AC loss of the magnet assembly. The thermal loss to destabilize the AC operation of the magnet is carefully estimated and confirmed by using two different methods for cross-checking; electrical and caloric (direct temperature rise measurement) ones. The novel scheme of in situ quench detection technique is employed to eliminate an electrical inductive pick-up noise of the auxiliary metal components as well as HTS so that the non-inductive voltage signal is reliably utilized for judging the quench event of the conduction-cooled magnet. This paper addresses fast-ramping characteristic issues of HTS magnet operation for continuous ADR. The analysis of the detailed pre-quench signal prior to full quench is an essential procedure that can determine the maximum performance of ADR. The developed conduction-cooled magnet shall be indispensable for running the integrated continuous ADR operating between 5 K and 2 K.

Primary author: Prof. JEONG, Sangkwon (KAIST)

Co-authors: KIM, Bokeum (KAIST); Mr KWON, Dohoon (KAIST); Mr YANG, Yejun (KAIST)

Presenter: Prof. JEONG, Sangkwon (KAIST)

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