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Mon-Mo-Po1.08-06 [92]: A solid nitrogen cooling system for HTS magnets

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The high temperature superconducting (HTS) magnets cooled by solid nitrogen (SN₂) are of great merits of lower thermal temperature gradient, better thermal uniformity and thermal stability. However, the existing cooling system cannot provide a long-term stable low-temperature circumstance for HTS magnets due to significant heat load, since they are not specially designed for the SN₂. Meantime, due to the large density and thickness of the stainless steel, which is the main constituent constructing the cryostat, the whole system is too weight to realize the compact and light-weight design of the HTS magnets. To overcome these shortcomings, we utilized two radiation shields, which are cooled by liquid nitrogen and first stage of cryocooler, to reduce the heat load of SN₂ cooling system as well as to improve the working time of SN₂ in this study. And we have introduced a pluggable cryocooler to reduce the whole weight of the SN₂ cryostat. Afterwards, we have investigated the performance of the presented cooling system in conjunction with HTS magnets, the theoretical calculation shows that the 20 liters of SN₂ can work more than 6 hours from 30K to 40K without any operating and thermal problems. The results of this work could provide a diagram for the future design and construction of high efficiency SN₂ cooling system for HTS magnets.

Key words: Solid nitrogen; Cooling system; HTS magnets; Heat load

Primary author: Mr LUO, Zhen (Southwest jiaotong university)

Co-authors: Prof. MA, Guangtong (Southwest jiaotong university); Mr NIE, Xingchao (Southwest jiaotong university)

Presenter: Mr LUO, Zhen (Southwest jiaotong university)

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