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Study on Forced Flow Cooling of Superconducting Magnet for Compact Synchrotron

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Abstract : To cool the superconducting magnets of compact synchrotron, a forced flow cooling system based on GM/J-T concept with cooling capacity of 10 watts at 4.5K is researched. The cooling system consists of heat exchanger, precooling system, J-T valve and forced flow cooling tank. In refrigeration process, high pressure helium is cooled by the heat exchanger and precooling system, and then liquefied by the JT valve. To elucidate the performance of the heat exchanger based on enthalpy balance, the cycle point parameters are picked. Results of the experiment show the relations of temperature, mass flow rate and pressure of helium at the inlet of J-T valve on the cooling capacity of the system. Heat leakage analysis, design parameters optimization and cycle efficiency improvement in the system are also discussed in this paper.

Keywords: Helium refrigerator, Cryogenic system, Thermodynamic analysis, Heat leakage analysis, cooling capacity

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