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C2Po3A-02: Development of the zero liquid helium consumption cryostat for a superconducting undulator

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Superconducting undulators have become a research hotspot of the insertion devices in the synchrotron radiation facility. However, the cryostat, which is used to create a liquid helium temperature environment, often causes the failure of the superconducting undulator. In this work, a cryostat with a new refrigeration distribution for a superconducting undulator is designed, fabricated and tested. For the cooling of the superconducting magnet, a liquid helium circulation loop based on the thermosiphon effect is designed with no moving component. The systematic thermal analysis and optimization are carried out to minimize the total heat load. The cooling capacity matches the heat load at different temperatures well and the theoretical excess cooling capacity is increased. In the experiment, the cryostat was tested with several superconducting magnets. There was no liquid helium consumption with excess cooling capacity in the test. Finally, the superconducting magnet reached a direct current of more than 450 A. This study can be a reference for the development of superconducting undulator cryostats.

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