

Development and comparison of two different types of dry dilution refrigerator

T. Hata, T. Matsumoto, K. Obara, H. Yano, and O. Ishikawa

Graduate School of Science, Osaka City University, Japan

Dilution refrigerator is necessary for solid state physics and quantum fluid physics as a tool to produce below 0.3K. We have to recharge liquid helium every a few days and consume a lot of liquid helium in conventional dilution refrigerator. Dry dilution refrigerators, however, do not need liquid helium and can be operated automatically. In near future, therefore, conventional dilution refrigerator will be replaced by dry one due to the easy operation, maintenance free and conservation of helium resources. We have developed two different types of dry dilution refrigerator. One is directly cooled by pulse tube refrigerator in a same cryostat using copper thin wires as a thermal link, and another is cooled by separated GM refrigerator using circulating helium gas through a flexible syphon tube. The latter has been developed for vibration free dry dilution refrigerator. We will compare these two different types of dry dilution refrigerator about several key points: base temperature, precooling time, minimum temperature, helium three circulation rate and cooling power.

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