

Performance of the Helium Circulation System on a Commercialized MEG

T. Takeda, M. Okamoto, T. Miyazaki, and K. Katagiri

Department of Complexity Science and Engineering, Tokyo University, 5-1-5 Kashiwa, Japan

We report the characteristics of the Helium Circulation System (HCS) mounted on a MEG of Nagoya University, Japan, that is the first commercialized HCS. It collects warm helium gas about 300 K, cools it to about 40K and returns it to the neck tube of the Dewar of the MEG to keep it cold. It also collects helium gas just above the liquid helium surface while it is still cold, re-liquefies and returns it to the Dewar. A special transfer tube (TT) about 2 m length was developed to allow the dual helium streams. It separates the HCS with a MEG to reduce magnetic noise. A refiner to collect the contaminating gases effectively by freezing the gases is incorporated. It has an electric heater to remove the frozen contamination in the form of gases into the air. A gas flow controller is also developed, which automatically control the heater to cleanup the contamination. The developed TT has very low heat inflow less than 0.1W/m to the liquid helium ensuring the efficient operation. The HCS can re-liquefy up to 35.5 l/D of liquid helium from the evaporated helium gas using two 1.5W@4.2K GM cry-coolers (SRDK-415D, Sumitomo Heavy Industries, Ltd.). Our MEG system has been used in real brain experiments without any problem over three years. Diameter of insert tube is reduced to the standard 1/2 inch. As the amount of liquid helium used decreases less than one percent, the maintenance cost of the MEG becomes less than one-tenth of the previous cost.