Present status of liquid-helium supply and recovery system

T. Dantsuka,[*1] H. Okuno,[*1] M. Nakamura,[*1] S. Tsuruma,[*1] M. Takahashi,[*1] M. Ohshima,[*2] H. Shiraki,[*2] H. Hirai,[*2] K. Kimura,[*2] S. Okada,[*2] A. Mikami,[*2] M. Nagano,[*2] H. Shiba,[*2] and H. Hazama[*2]

A liquid-helium supply and recovery system,[1] which can produce liquid helium at a liquefaction rate of 200 L/h from pure helium gas, has been under stable operation since the beginning of April 2001. However, owing to increased operational failures caused by deterioration over time, the liquefier was duplicated in 2017. The new liquefier can produce liquid helium at a liquefaction rate of 220 L/h from pure helium gas. Although the old liquefier has been failing since the summer of 2018, the new provides a constant supply of liquid helium. The old liquefier was repaired in February 2020.

The volumes of liquid helium supplied each year from 2001 to 2022 are depicted in Fig. 1. From 2001 to 2013, there was a gradual increase in the supplied volume, with two decrements in 2009 and 2011. In 2014, the supplied volume decreased owing to a system malfunction. However, in 2015, it returned to its original value. In 2016, the supplied volume decreased, whereas it increased slightly in 2017 and significantly in 2018. In 2019, approximately 140,000 L of liquid helium was supplied despite the high price of helium gas. In 2020, a decrease in the supply volume of approximately 15,000 L was caused owing to the effect of the coronavirus. In 2021, the supplied volume increased slightly and then decreased by approximately 17,000 L in 2022.

Moreover, the purity of helium gas recovered from the laboratories has gradually deteriorated. The main cause of the problem was found to be the age-related deterioration of the inner membrane of gas holder E. Owing to the contamination caused by air, the purity of the recovered gas was found to be reduced to approximately 95%. Currently, the gas holder E is disconnected and operated collectively with gas holder A.

Furthermore, the volume of helium gas recovered from each building in the Wako campus as well as the volume transported to the liquid-helium supply and recovery system were measured. The recovery efficiency was calculated as the ratio of the amount of recovered helium gas to the amount of supplied liquid helium. The recovery efficiencies for the buildings on the south side of the Wako campus, that is the Cooperation Center building of the Advanced Device Laboratory, Chemistry and Material Physics building, and Nanoscience Joint Laboratory building, were maintained to approximately 98%.

Reference

1) K. Ikegami *et al.*, RIKEN Accel. Prog. Rep. **34**, 349 (2001).

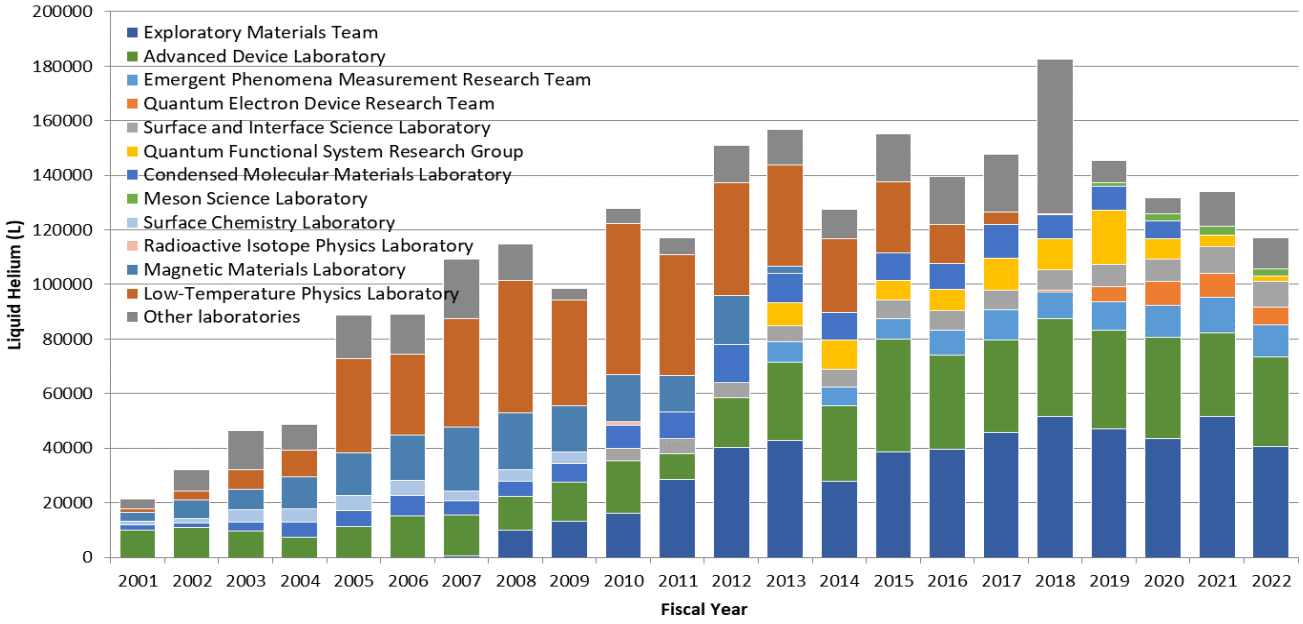

Fig. 1. Volumes of liquid helium supplied to various laboratories for each fiscal year from 2001 to 2022.

*1 RIKEN Nishina Center
*2 Nippon Air Conditioning Service K.K.

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