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Technical note

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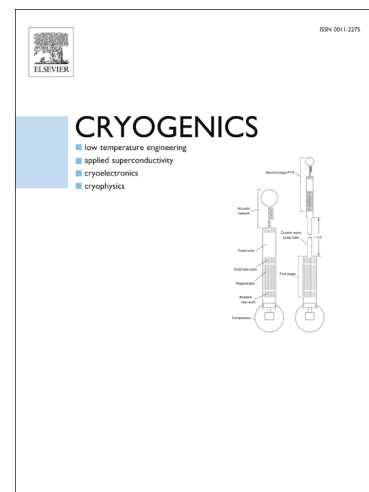
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Experimental investigation on the cooling helium circulation of the internal purifier pilot plant

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Abstract: The internal purifier is utilized to remove impurities from impure helium, keep the helium free of any gaseous contaminants. However, there is few report on the performance improvement of the internal purifier. In this paper, we present a novel circuit of the experimental platform with GM cryocooler providing a separated cooling helium circulation as the refrigeration power supply for investigating the performance the internal purifier. Namely, that circuit is easily constructed by extracting a small stream of helium from the high-pressure side of the GM cryocooler serving as the cooling helium circulation. The experiment is then carried out to test the mass flow and the temperature of the cooling helium circulation. The impact of the modification on the cold head is also estimated. It is finally demonstrated that the circuit is sufficient to guarantee the cooling supply of the whole experimental system, which means that the modification is suitable and efficient.

Keywords: the internal purifier; cooling helium circulation; impurities; impure helium; cryogenic

1. Introduction

In the helium system, there must be a kind of purifier to recycle the impure helium as it is the scarce and non-renewable source in the world. In addition, in the use of gaseous helium to develop refrigeration at cryogenic temperature, it requires that the purity of helium gas can be reached over 99.9995%. It is because the presence of any contaminants would plug the passages of the heat exchangers by freezing out as solids at the cryogenic temperature. That will make the cryogenic apparatus inoperative. Therefore, a helium purifier is an indispensable part of any cryogenic establishment to recycle helium gas.

The pioneer work can be traced to Collins originally in 1974[1] obtaining the Patent for helium purification method and apparatus. The patent described a method and apparatus which operated completely automatically for removing impurities from helium gas, requiring no externally supplied warming gas. After that, internal purifier has drawn increasing attention from researchers who study the helium refrigeration or liquefaction system. Most of them put focus on how to

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