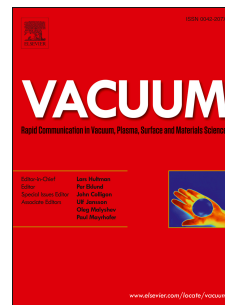


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Abstract: A molecular pump is always used as the main pump of the vacuum leak detection system because of its strong ability for pumping helium. But the pumping speed of a molecular pump is not enough for large vacuum chamber. A cryopump is a clean, oil-free and high pumping-speed vacuum pump. If a cryopump is used as the main pump of the vacuum leak detection system, the number of the pumps will decrease. This paper describes the experiments on vacuum leak detection system with cryopump as a main pump, and analyses the phenomena in the experiments. The results show that the cryopump decreased the vacuum pressure of the system significantly, but it had nearly no influence to the system sensitivity. The response time and the clean-up time of the leak detection system with only molecular pump were both 3 minutes. But the response time of the leak detection system with both molecular pump and cryopump was 10 minutes to 20 minutes, and the clean-up time of the system was longer than an hour.

Key words: leak detection, cryopump, sensitivity, response time, clean-up time

1. Introduction

A gas leak on orbit is a fatal fault for spacecraft, so a series of leak tests are carried out during the process of manufacturing and assembling [1-3]. Helium leak testing method has much higher sensitivity than other methods [4-9]. In order to gain high leak testing sensitivity, a spacecraft should undergo a helium leak test in large vacuum chamber [10]. Although a cryopump is a clean, oil-free and high pumping-speed vacuum pump, and it is always used as the main pump for large vacuum chamber, a molecular pump is always used as the main pump of the vacuum leak detection system, because a molecular pump has much higher ability for pumping helium than a cryopump [11-14]. A cryopump has much higher ability for pumping atmosphere than a molecular pump, so the number of pumps used in the vacuum system and the cost for constructing the facility will decrease if a cryopump is used as the main pump of the leak detection system for spacecraft. For example, 20 DN320 molecular pumps are needed for a large vacuum chamber with a volume of 100m^3 , but 2 DN900 cryopumps are enough for this kind of chamber. If both molecular pump and cryopump are used in the vacuum leak detection system, it will combine the benefits of molecular pump and cryopump. This paper describes the effects of cryopump on the vacuum helium leak detection system.

2. Experimental

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