

High-speed Pumping to UHV

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1. Introduction

In order to reduce electric power for vacuum systems considering the global warming problem, one of the most important measures in vacuum technology should be high-speed pumping down to desired pressure for application work. It is known that high-speed pumping is limited by water desorption from chamber surface¹⁻⁴). Here we focus improvement of outgassing from the surface taking into account of surface treatment and water vapor from a nitrogen purge gas line.

2. Experimental

The main chamber is made of a type 304 stainless steel of which the surface treatment was buff-polished and electrolytic-polished sequentially. Outgassing rate for the upstream chamber with a surface area of about 0.19m² was measured with an orifice (5.3 x 10⁻³ m³/sec, 310K). The pumping system consists of a turbo molecular pump (TMP) and another TMP in series, backed with a dry scroll pump. Pressure was measured with a combination gauge of Pirani and B-A. Residual gas component were analyzed with a quadrupole mass spectrometer (RGA). And the dewpoint transducer was used for controlling water vapor in nitrogen gas in a purge line.

3. Result and discussion

Fig.1 shows a typical pumping curve (a) and an outgassing rate (b) at the system which had been never baked after the main chamber was filled with nitrogen gas (1 atm, 1 hour, dewpoint : -67.3°C) through the purge gas line. The pressure achieved lower than 1.0 x 10⁻⁴Pa

in 85 seconds (outgassing rate : 2.7 x 10⁻⁶ Pa m³ / s m²) through the orifice after pumping started and reached lower than 1.0 x 10⁻⁵Pa in 14 minutes (outgassing rate : 2.7 x 10⁻⁷ Pa m³ / s m²). It was also found that the main residual gas in the chamber was hydrogen that is equivalent to residual gas in a baked UHV system. These results show the remarkably low outgassing rate in a short time owing to the surface treatments and the water vapor control in nitrogen gas.

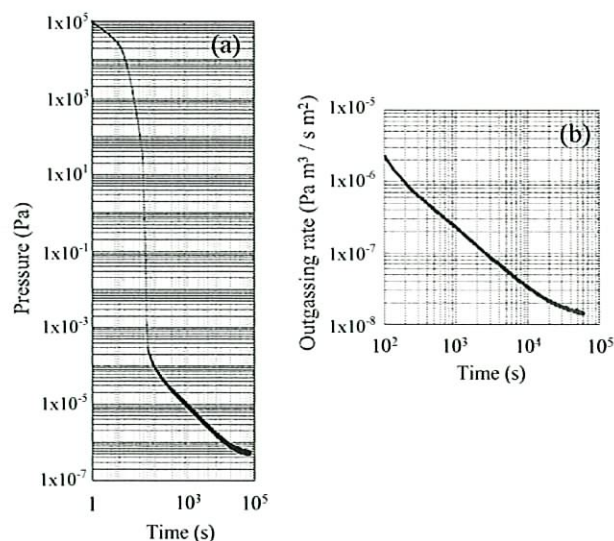


Fig. 1 (a) pumping curve from 1 atm for 20 hour,
(b) the outgassing rate

References

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