Photodesorption of Glid-Cop by High Energy Photon

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In the design and manufacture of the vacuum system for the SPring-8 storage ring, interaction of synchrotron radiation (SR) with absorbers is one of main problems to be considered . To investigate the influence of the interactions we measured the photodesorption yield of Glid-Cop (Al_2O_3-0.15% dispersion strengthened copper), the material of the irradiated section on the absorber, using the high energy photon beam (the critical energy 26 keV) from the Accumulation Ring (AR) of TRISTAN at KEK. This experimental result is compared with that of the potodesorption yield of OFHC-class1 (oxygen free copper) measured previously [1].

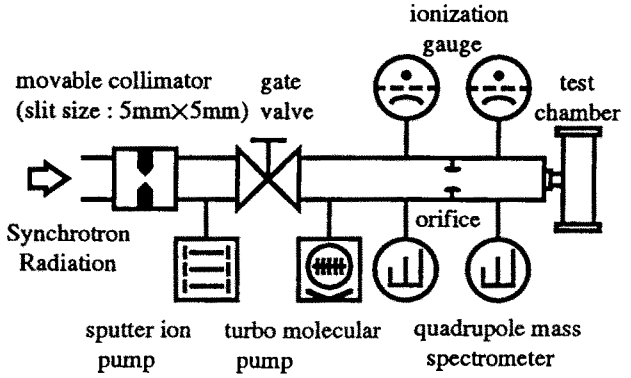

Fig. 1. Schematic drawing of the photon beamline (AR-NE9).

Figure 1 shows experimental scheme which is similar to that in our previous experiment. The SR irradiated on the test chamber is adjusted with a collimator slit of 5 mm x 5 mm, and is incident perpendicularly on the inner wall of test chamber. The test chamber is cylindrical tube of 300 mm x ϕ 60 mm made of Glid-Cop. The outline of the productions of the test chamber is as follows; oilless machining, brazing, chemical cleaning, and 10 hours bakeout at 450 ℃. The chamber was evacuated and baked out over half a day at 150 ℃ before the SR irradiation, and thereby the background pressure for experiments was 5.5×10^{-7} Pa. The chamber was cooled with water to reduce thermal desorption during experiments. The outgassing rate due to photodesorption was obtained by through-put method.

Figure 2 shows the relation between the photodesorption yields (η) and the photon dose (Dp). The η are nearly constant below the Dp of 10^{20} photons/slit and decrease with an increase in the Dp. above that. The η of OFHC and Glid-Cop at Dp of 10^{21} photons/slit were 1.3×10^{-4} molecules/photon and 2.8×10^{-4} molecules/photon, respectively. The η of Glid-Cop were a few times larger than that of OFHC.

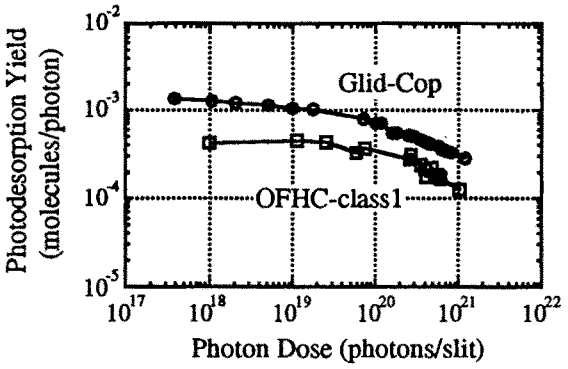

Fig.2. Photodesorption yields of OFHC-class1 and Glid-Cop estimated by equivalent nitrogen pressure.

Since most of the absorber chamber is made of extruded alluminum alloy (A6063) in our case, we must consider the secondary photodesorption of the alluminum alloy. Experimental results using the photon beam with the critical energy of 4 keV from the 2.5 GeV storage ring of Photon Factory at KEK showed that the η of extruded alluminum alloy (A6063) was an order of magnitude large than the η

of OFHC [2]. These suggest that the influence on vacuum by the secondary photodesorption of the alluminum alloy is larger than that for Glid-Cop. We consider that most of the SR-induced gases are mainly desorbed from the alluminum alloy in the absorber chamber and that the use of Glid- Cop as the absorber has little influnce on vacuum.

References

[1] K.Watanabe et al. : RIKEN Accel. Prog. Rep. 26, 163 (1992).

[2] S.Ueda et al. : Vacuum, 41, No.7-9, 1928 (1990).