(BL5B)

Absolute yield of exciton induced desorption from the surface of solid Ne

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We have been studying the desorption of excited particles from the surface of rare gas solids (RGSs) induced by exciton creation using photon- and electron- stimulated desorption (PSD and ESD) techniques[1]. The mechanisms for the desorption of exited atoms in the excitonic energy region have been well established in these 10 years by measuring the kinetic energy, angular distribution, and excitation energy dependence using a synchrotron radiation[2, 3]. Absolute desorption yield can be an essential information for the quantitative understanding for the desorption dynamics. Hirayama et al. [4] first reported the absolute yield for exciton induced desorption of the metastable atoms from the surface of solid Ne. In the present study, we present the results for the total absolute yield for exciton induced desorption from the surface of solid Ne.

Experiments have been done at the beam line BL5B in UVSOR. The experimental setup is similar to the one used in our previous work[3] equipped with a quadrupole mass spectrometer (QMS400, ULVAC) in order to detect Ne molecules desorbed from the surface of solid Ne. Briefly, the sample substrate is a Pt(111) attached to the head of a rotatable liquid He cryostat installed in an UHV chamber (base pressure ~ 5×10^{-9} Pa). Absolute desorption yield has been estimated by the increase of Ne partial pressure measured by the quadrupole mass spectrometer, which is calibrated by using an extractor gauge (Lybolt). Pumping speed of a turbo molecular pump and the cryostat has been experimentally determined to be 0.16 m^3/s. Absolute number of the incident photon was measured using a photoelectric yield of Au plate as described in [4].

Figure 1 shows a wavelength dependence of the absolute desorption yield from the surface of solid Ne whose thickness is about 35 atomic monolayers. Positions of the first and second order bulk excitons (B1, B2) and the band gap energy (E_g) are marked in the figure. Only peak of bulk excitons has been appeared. Yield at the surface exciton (first order surface exciton, S1: 72.3 nm, $2p^5$3p-type surface exciton, S': 65.4 nm) are less than our detection sensitivity (~ 0.1 atoms/photon). A broad peak at around 80 ~ 90 nm, where the excitation energy is below the lowest energy of the exciton creation (S1: 72.3 nm), is attributed to the desorption induced by the secondary electrons emitted from the platinum substrate. Unexpectedly large desorption yield (order of unity) can be explained by such a mechanism that the bulk exciton created near the surface, namely, second or third layer, desorbs via cavity ejection mechanism together with some ground state atoms around the excited atom. Further analysis is in progress.

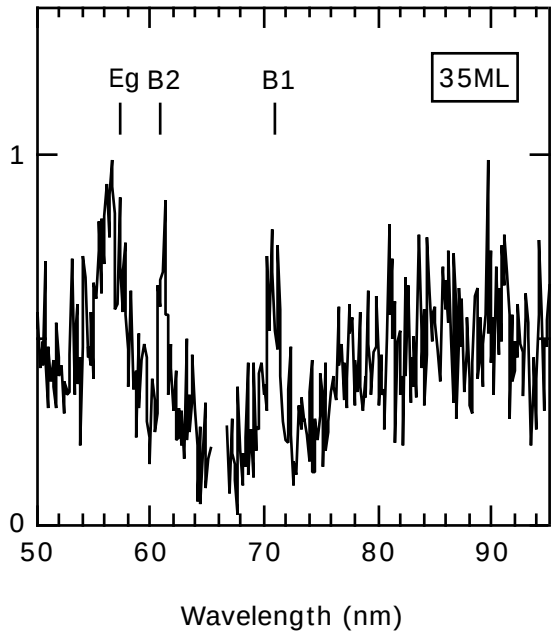

Fig.1. Excitation wavelength dependence of the absolute desorption yield from the surface of solid Ne.

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