ELECTRONIC EXCITATION INDUCED DESORPTION OF EXCITED ATOMS AND EXCIMERS FROM THE SURFACE OF SOLID Ne

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Desorption of excited atoms and excimers induced by valence exciton excitation from the surface of solid Ne by low energy electron and photon irradiation will be presented. Excimer $(Ne_2 * {}^3 \ _u)$ desorption was experimentally confirmed for the first time, and was found to be well described in the frame work of cavity ejection mechanism as in the atomic desorption case.

When a low energy electron or photon is incident on the surface of rare gas solids, various electronic excitation processes and subsequent de-excitation (relaxation) processes occur.¹ Interaction of the excited atom (exciton) with the surrounding ground state atoms plays an essential role in the relaxation process. In order to reveal the dynamical aspects of the excitons, we have studied desorption of excited atoms and excimers from the surface of rare gas solids induced by exciton creation.

As to the neutral atom desorption induced by exciton creation, two mechanisms, excimer dissociation (ED) and cavity ejection (CE), were proposed² and have been confirmed experimentally.³ The desorption via ED process is due to a dissociation of a molecular type self-trapped exciton (m-STE) similar to the dissociation of an excited dimer (excimer) in the gas phase. It is still an open question whether the dissociation occurs before or after the desorption.⁴ Negative electron affinity of the



Fig.1. Desorption yield of (a) excited Ne atom⁷ in $2p^53s$ ${}^{3}P_{0,2}$ states and (b) Ne excimer in 3 u states⁸ as a function of wavelength of incident light. Assignment of the 1st order surface (S1) and bulk (B1), $2p^53p$ -type surface (S'), 2nd and 3rd bulk (B2, B3) excitons are shown.

matrix is known to be essential for the CE process to have a repulsive interaction between the excited atom and the surrounding ground state atoms, so that desorbed atoms via the CE mechanism are essentially in excited states. Figure 1(a) shows the desorption yield of excited atom in $2p^53s$ ($^{3}P_{0,2}$) state as a function of wavelength of excitation light.⁷ Each peak well corresponds to the energy of valence exciton creation.

Desorption of an excimer from solid rare gases has been predicted theoretically for solid Ne, Ar and Kr, while experimental evidence has been obtained only for Ar.⁵ We have previously observed the emission from the desorbed particles with long lifetime from the surface of solid Ne, which is thought to be closely related to Ne₂* desorption.⁶ In order to confirm the desorption of Ne₂*, we have measured the spatial distribution of VUV light emitted from the desorbed excited species using a pinhole camera, which consists of a pin hole with 3 mm in diameter, a MCP with 75 mm in diameter, and 2dimensional position sensitive detector.

Measured radiative lifetime is in good agreement with that of Ne₂* (³ _u) in gas phase. It is also shown that the excimer desorbs before vibrational relaxation. It is clearly shown from fig.1(b)⁸ that the desorption of an excimer is also initiated by the formation of an exciton as the atomic desorption case. Measured kinetic energy of desorbed excimer (0.2 \pm 0.1 eV) suggests that the mechanism of excimer desorption can be explained also by the cavity ejection model. Detailed discussion will be presented in the conference.

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