§11. The Spatial Distribution of Hα Radiation Intensity by Proton Impact on Polycrystalline Tungsten Surface

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Tungsten is planned to use as material for the divertor plates in ITER because of the high sputtering threshold energy for light ion bombardment, the highest melting point among all the elements, and less tritium retention compared with carbon-based materials 1)-3). Divertor plates in a fusion device are exposed to high intensity heat fluxes of energetic particles. Many experiments indicate that tungsten retains tritium and deuterium due to their bombardment of hydrogen isotope plasma. The resultant retentions of the isotopes raise to the safety and economic problems, and should be minimizes for future fusion reactor operations. Thus, many efforts are being made to predict hydrogen isotopes retention in various forms of tungsten under the actual fusion reactor condition. The retention, reflection, recycling, sputtering of hydrogen isotope atom in tungsten surface attracts extensive attention from the viewpoint of estimating the inventory of tritium atoms in a nuclear fusion device. We paid attention to the reflection processes of the hydrogen atoms by the proton irradiation to the tungsten surface, and then we measured spatial intensity distribution of the Hα line from reflected hydrogen.

In this work, we report about the mean velocities under the irradiation of H^+ ion. Briefly, we measured the spatial distribution of Hα line intensity from reflected H* atoms under irradiation of H^+ ion-beam (35keV). Using the analysis of decay curve, we estimated the mean vertical velocity component in direction normal to the surface. The intensity decay follows the well-known relation,

$$I = \sum_k I_{0k} \exp\left(- \frac{z}{< v_\perp > \tau_k} \right) \quad .$$

Where I_{ok} is the intensity from a particular transition k at the surface (**z** =0), $v_\perp$ is the vertical velocity component normal to the surface, τ_k is the lifetime of the excited state. Figure 1 shows the two-dimensional spatial Hα line intensity distributions. The polycrystalline tungsten surface is located at Z = 650 (pixel). Reflected hydrogen atoms which emit Hα are strongly reflected in the direction of 180 degrees with respect to the incident protons. Figure 2 shows the decay curve of Hα line intensity. From this decay curve, the mean vertical velocity was estimated at 320km/s.

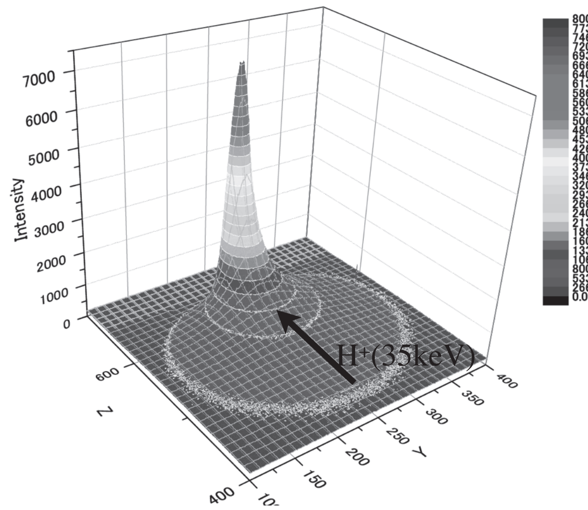

Fig. 1. The spatial distribution of Hα radiation intensity by H^+ impact (35keV) on W surface.

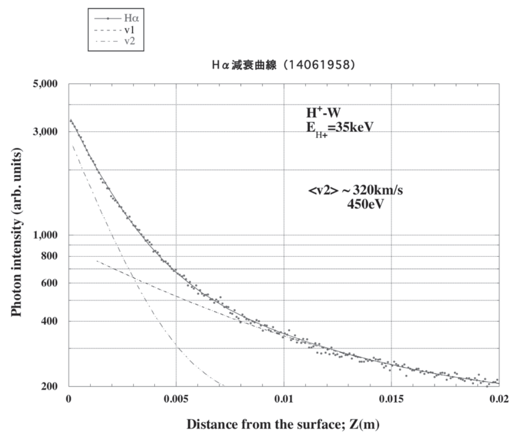

Fig. 2. The decay curve of Hα line intensity.

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