§12. The Incidence Ion Angle dependence of Hα Radiation Intensity Distribution 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. 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 retention, reflection, recycling and 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. Therefore we paid attention to the sputtering processes by the high-energy particles[1)] and the reflection processes of the hydrogen atoms by the proton irradiation to the tungsten surface. Then we measured spatial intensity distribution of the Hα line from reflected hydrogen.

In this paper, we report about the incidence ion angle dependence of Hα line intensity from reflected H* atoms under irradiation of H^+ ion-beam (35keV) at incidence angle 90 and 45 degrees. Fig. 1 shows a schematic illustration of the experimental apparatus.

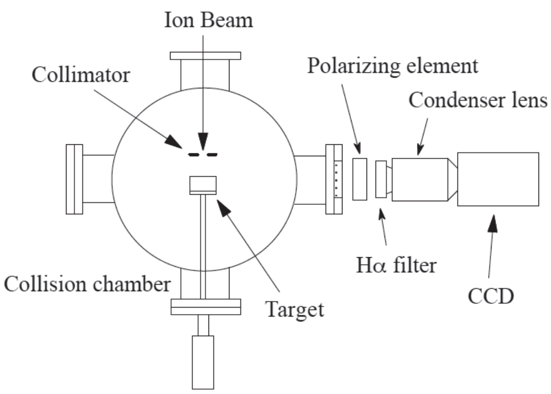

Fig. 1. A schematic illustration of the experimental apparatus.

We observed the light emission on a polycrystalline tungsten surface under irradiation of H^+ ions by using this apparatus. H^+ ion produced by Freeman-type ion source was introduced into the collision chamber through a collimation hole with 5mm diameter. The ion beam entered to a polycrystalline tungsten surface which was set on a linear-motion feed-through at 90 and 45 degree. The two-dimensional (2D) images of Hα light emission take by the CCD camera through Hα filter and a condenser lens. The current and energy of the H^+ ion beam were 10~50 μA and 35 keV, respectively. The pressure of the chamber maintained below 1×10^{-6} Pa by a turbo molecular pump. In Fig.2 and 3, the spatial distributions of Hα radiation intensity are shown. The incidence angles of proton are 90 and 45 degrees, respectively. The intensity distribution of Hα radiation is axial symmetry in direction normal to a tungsten surface at 90 degree. However, it was confirmed that the intensity distribution of which proton's incidence angle is 45 degree is asymmetry in comparison with the vertical incidence from these experimental results.

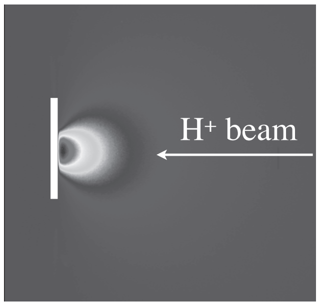

Fig. 2. The spatial distribution of Hα radiation intensity by H^+ impact on W surface at 90 degree.

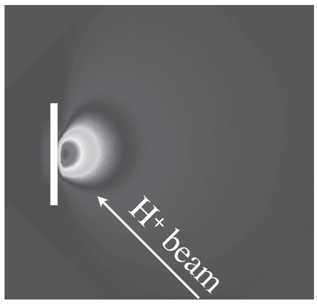

Fig. 3. The spatial distribution of Hα radiation intensity by H^+ impact on W surface at 45 degree.

1) K. Nogami, Y. akai, S. Mineta, D. Kato, I. Murakami, H. A. Sakaue, T. Kenmotsu, K. Furuya, K. Motohashi J. Vac. Sci. Technol. A 33(6), 061602 (2015)