

Work Function Measurement of a Surface Simulating The Plasma Grid of a H^- Ion Source

水素負イオン源プラズマグリッドを模擬した表面の仕事関数測定

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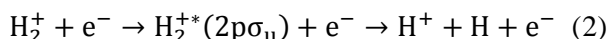
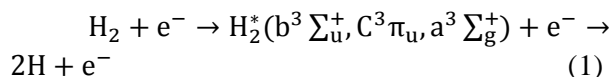
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An ultra high vacuum system has been prepared to study surface condition of low work function metal surface in a condition similar to the actual ion source operation. While the clean surface can be prepared in the chamber, a flux of thermal atomic hydrogen can be directed to the target surface to make the surface saturate with hydrogen, i.e, condition similar to an ion source. Correlation between the work function and the efficiency to convert a hydrogen atom to a negative hydrogen ion is studied.

1. Introduction

Large current negative hydrogen (H^-) ion source are operated with Cs introduced in the discharge as Cs in the discharge increases H^- current by several folds [1]. The enhancement of H^- current by Cs injection is believed independent from the volume process;



But the enhancement had been attributed to surface production formally studied by medium energy range of hydrogen ion incidence onto low work function surface[2][3]. On this system, the surface work function is reduced following semi-empirical formula proposed by Alton[4].

$$\varphi_{\min} = 0.62 \times (I_a + E_a) - 0.24\varphi_0 \quad (3)$$

As Cs has a very small value of I_a the resulting minimum become small for refractory metal having large φ_0 . The present experiment aims cut confirming eq. (3) with characterizing the surface ability to negatively ionize atomic hydrogen, which may play an important role in H^- ion production in an actual ion source.

2. Experiment setup

The low work function surface is prepared by a Cs oven on a target installed on rotation holder. The work function of the target is measured by photo-electric method [5] out of diode laser light

irradiation. A lock-in amplifier detects photoelectric current from the target from phase sensitive detection realized by chopping the incident light. The correlation between the efficiency to convert thermal and the work function is studied. A schematic diagram of the experimental setup is shown in Fig. 1.

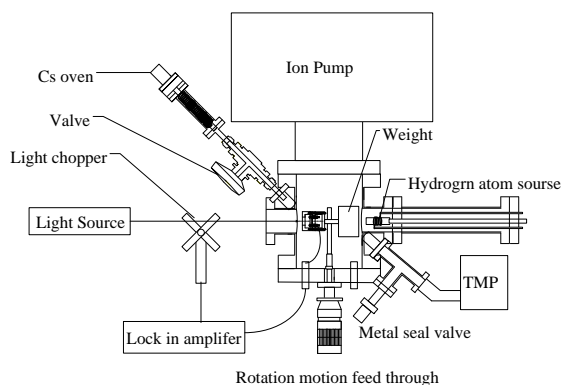


Fig. 1. A schematic diagram of the experimental setup

References

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