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Development of the Low Energy Ion Source to investigate Plasma-Wall-Interaction

プラズマ−固体表面相互作用調査のための低エネルギーイオン源の研究開発

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1. Introduction

The data sets on particle-surface interaction including ion reflection and secondary electron emission for ion energy incident less than 100 eV refractory against metals are important in modeling the plasma at the vicinity of nuclear fusion reactor wall. Physical sputtering and particle reflection are the two of those affect the plasma properties near the plasma facing components. For the longer operation of nuclear fusion devices, hydrogen isotope retention alters the sputtering yields and reflection components. In this study, a low energy ion source that can deliver ions less than several hundred eV is being developed to put into operation at the surface reflection measurement apparatus at National Institute of Fusion Science.

2. Experimental apparatus

The ion source has been designed adaptive to a standard 114 mm diameter metal gasket flange. The source of the structure shown in Fig.1 has been assembled and attached to a pumping station with a faraday cup mounted downstream of the extractor electrode. All vacuum sealing are made with metal gaskets to avoid any possible slow leak. The dimensions of the discharge area of the source are 55 mm diameter and 75 mm length. A steady stale discharge is maintained between a 0.35 mm diameter 60 mm long W cathode and a stainless steel anode. The discharge chamber wall is at the floating potential to electro statically confine the primary electrons. A floating potential plasma grid is made of Ni, and has a 1 mm hole to extract ion beam from the plasma. Hole sizes of acceleration and ground grids are also 1 mm, and the spacing between the plasma grid and the acceleration grid is 2 mm. Meanwhile, the gap between the acceleration grid and the plasma grid is 3 mm. The source performance is being investigated using hydrogen gas.

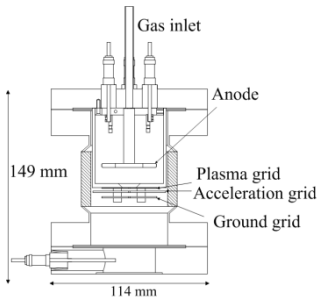

Fig.1. Schematic diagram of ion source.

Fig.2. Photograph of the ion source.