

Hydrogen Concentration and Crystal Structure of Carbon Films produced at the duct of Local Island Divertor in Large Helical Device

Tomoya Hirata¹, Yuji Nobuta¹, Tomoaki Hino¹, Suguru Masuzaki², Naoko Ashikawa², Yuji Yamauchi¹, Yuko Hirohata¹, Akio Sagara², Kiyohiko Nishimura², Nobuyoshi Ohyabu², Nobuaki Noda², Akio Komori², Osamu Motojima², LHD Experimental Group²

1) Laboratory of Plasma Physics and Engineering, Hokkaido University, Sapporo, 060-8628, Japan
2) National Institute of Fusion Science, Toki-shi, Gifu-ken, 509-5292, Japan

e-mail address of submitting author: y-nobuta@eng.hokudai.ac.jp

In order to investigate relationship between structure of carbon film, wall temperature and hydrogen concentration, two sets of material probes were installed at the pumping duct of Local Island Divertor (LID) in Large Helical Device (LHD). One set of the material probes (1U & 1L) were face to the LID head made of carbon fiber composite (CFC), and the other set (2U & 2L) were far from the head (see Fig.1). The surface morphology, the depth profile of atomic composition, thickness of the films, the amount of retained hydrogen in the films and crystal structure of the films were analyzed and hydrogen concentration in the probes was estimated.

On all the probes, carbon deposition layers with a thickness of several hundreds nm were found. On the surface of 1U and 1L, sub-micron size protuberant structures were observed, while the surfaces of 2U and 2L were very smooth. The hydrogen concentration in the carbon films on the probes close to the LID head (1U and 1L) where wall temperature became up to 570 K was 0.55 in the atomic ratio of H/C. On the other hand, the hydrogen concentration in the carbon films on the probes far from the head (2U and 2L) where wall temperature 327 K was significantly large, 1.25 in the atomic ratio. These values were several times of magnitude larger than that in graphite after hydrogen ion irradiation. In XRD and Raman analysis, it was found that these carbon films had polymer like structures.

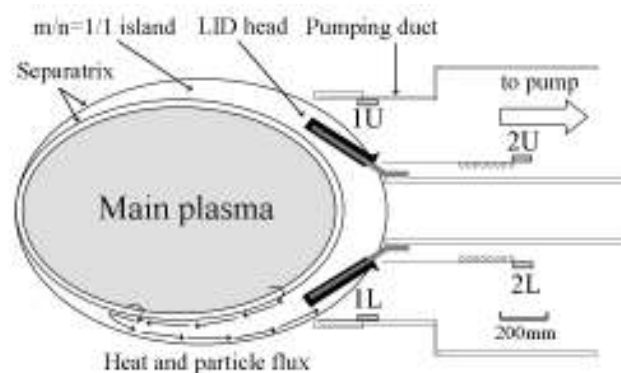


Fig.1 Schematic view of the LID configuration.