§43. Helium Retention Properties of Nickel for Scheme of Helium Ash Reduction

Hino, T., Yanagihara, H., Hirohata, Y.,
Yamashina, T. (Hokkaido Univ.)
Motojima, O., Yamazaki, K.

In a fusion reactor, one of important issues is to effectively remove the helium ash in order to avoid the enlargement of a plasma size or to sustain the self ignition condition. For this purpose, the use of the poloidal divertor alone has a limit for the effective pumping. Thus, the additional scheme is necessary to reduce the inward flow of helium from the divertor. In particular, the additional method is important for the helical reactor since the connection length is relatively short.

For reduction of the helium ash, we have proposed to employ the helium selective pumping material in the vicinity of the divertor. If such the material can trap the helium alone, the inward flow should be considerably suppressed and then the level of the helium ash be reduced.

In order to find the possibility, the selective pumping capability of nickel for helium was investigated by using the ECR plasma device (Fig. 1). By changing the irradiation temperatures of the nickel, we irradiated the helium ions and the hydrogen ions, and after that the retained heliums and hydrogens were measured by a technique of thermal desorption spectroscopy (Fig. 2). In a case that the substrate temperature was higher than 100 °C, only the helium was selectively trapped in the nickel. The maximum amount of the helium was $2x10^{16}$ He/cm^2 at the temperature of 200 °C and 600 °C.

The present results show that the use of the nickel in the vicinity of the divertor can contribute to the reduction of the helium ash.

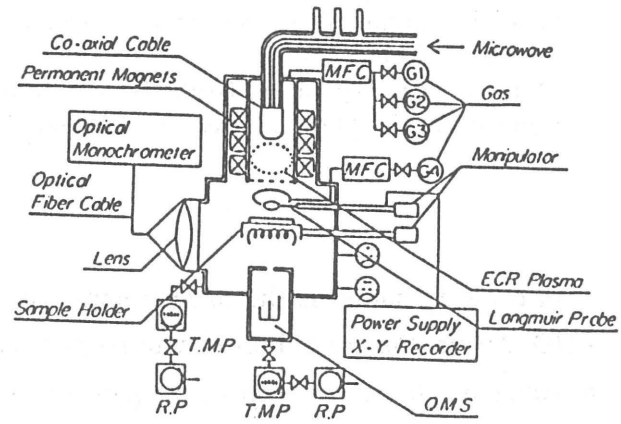

Fig.1. ECR plasma device.

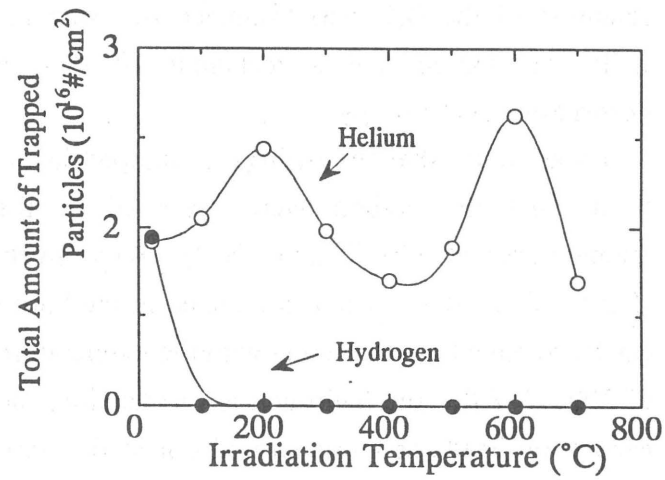

Fig.2. Amounts of trapped heliums and hydrogens of nickel versus irradiation temperature.

References

1)Hino, T., Yanagihara, H. and Yamashina, T., Fusion Eng. and Design, 24 (1994) 437.

2)Yanagihara, H., Hirohata, Y., Fujita, T., Hino, T. and Yamashina, T., J. Vac.Soc.Jpn., 37 (1994) 363.