# §30. Fuel Hydrogen Retention of SiC/SiC Composite and its Reduction

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SiC fiber reinforced SiC matrix (SiC/SiC) composites are promising as the plasma-facing material of a fusion reactor because of their low induced activation, low atomic number, high thermal shock resistance, good thermal conductivity and so on. Plasma-facing walls are exposed to fuel hydrogen and part of implanted hydrogen is retained in the material. From the point of view of tritium safety, tritium removal technique should be established. A glow discharge conditioning is widely used for hydrogen removal from plasma-facing surface. In this study, the effects of glow discharge using inert gases on hydrogen removal were investigated.

First, the SiC/SiC samples were irradiated by deuterium glow discharge plasma using glow discharge apparatus of Hokkaido University [1]. Then, the deuterium-irradiated samples were exposed to inert gas (He, Ne and Ar) glow plasmas to remove the retained deuterium. In order to evaluate how much of retained deuterium was removed by inert gas glow discharge, the change of amount of retained deuterium were investigated with thermal desorption spectroscopy (TDS).

Thermal desorption spectra for deuterium-irradiated samples before/after exposing to inert gas glow plasma were shown in Fig.1. The desorption spectra had a main peak at around 930 K. The authors have found that desorption spectra of $D_2$ after deuterium ion irradiation had two main peaks at around 950 K and 1200 K, which are responsible for Si-D and C-D bonds, respectively [2, 3]. In addition, it has been found that carbon atom on at SiC/SiC surface was selectively sputtered by deuterium ion irradiation [4]. For these reasons, the implanted deuterium in this study was considered to be trapped mainly by Si-D bonding. After the inert gas glow discharge, the desorption rate at 930 K decreased. The ratio of amount of removed deuterium after exposing to inert gas glow plasma is shown in Fig.2. It is found that Ar gas glow plasma was most effective for removal of implanted deuterium. This might be owing to a large sputtering rate of Ar for the SiC/SiC material.

[1] T. Hino, Fusion Engineering and Design, 85 (2010) 974.
[2] Y. Yamauchi et al., Vacuum, 47 (1996) 973.
[3] Y. Nobuta et al., Journal of the Vacuum Society of Japan, 55 (2012) 164.
[4] Y. Nobuta et al., Journal of the Vacuum Society of Japan, 54 (2011) 149.

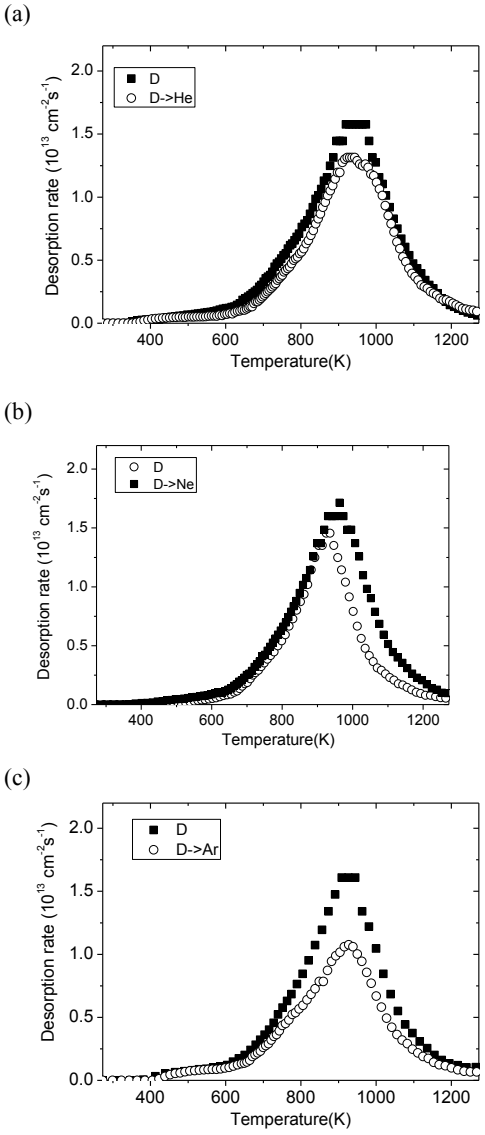


Figure 1 Change of thermal desorption spectra of $D_2$ after (a) helium, (b) neon and (c) argon glow discharge.

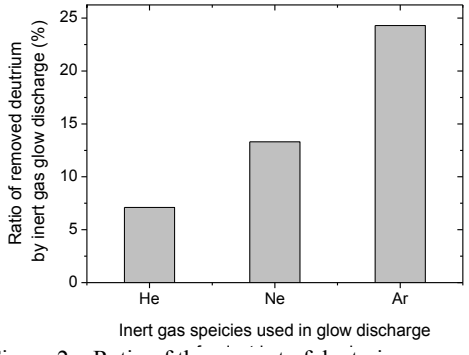


Figure 2 Ratio of the amount of deuterium removed by inert gas glow discharge