§80. Surface Analysis for Boronized Wall During 7th Experimental Campaign

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Boronization experiments were conducted from the 5th experimental campaign. Material probes were installed at 10 positions along the toroidal direction from the 6th experimental campaign and the toroidal uniformity of the boron deposition was investigated. In the 7th experimental campaign, the boron deposition was similarly investigated. The boronization during the 7th experimental campaign was three times conducted using glow discharge. Two anodes between toroidal sectors 1 and 10 and between toroidal sectors 4 and 5 were employed for the glow discharge. The diborane gas was driven from the inlets between toroidal sectors 1 and 2, between toroidal sectors 3 and 4 and between toroidal sectors 7 and 8. After the campaign, the material probes were extracted and the depth profile of atomic composition was examined using Auger electron spectroscopy.

The thickness of boron film largely depended on the toroidal position. Figure 1 (a), (b) and (c) show the depth profiles of atomic composition in the probes placed at the toroidal sectors 1, 2 and 3. In the positions close to the anodes (toroidal sectors: 1, 2, 4 and 10), the boron deposition was clearly observed. In opposition, the boron deposition was very small in the positions far from the anode (toroidal sectors 3, 6, 7, 8 and 9). Thickness of the boron film was as high as approximately 300 nm. These results suggest that the diborane gas has to be dissociated and/or ionized for the boron to deposit on the wall.

Figure 2 shows a plot of thickness of boron film against toroidal sector number. The ratio of the boronized wall to the entire wall was approximately 40 %, which was higher than the ratio in the 6th experimental campaign, 20-30 %. The amount of oxygen retained in the boron film was measured based upon the depth profile of atomic composition. This amount is also plotted in Fig. 2. The amount of oxygen was large at the positions with a high boron concentration. The oxygen might have been trapped during the boronization, and main and glow discharges. The oxygen impurity concentration in the LHD plasma was significantly reduced after the boronization. This reduction is clearly owing to the oxygen getter action of the boron film.

In the boron films at the toroidal sectors 1 and 10, the pealing of boron film and the blister formation were partly observed. The energetic particle bombardment and/or increase of heat flux during the NBI heating might have caused these erosions.

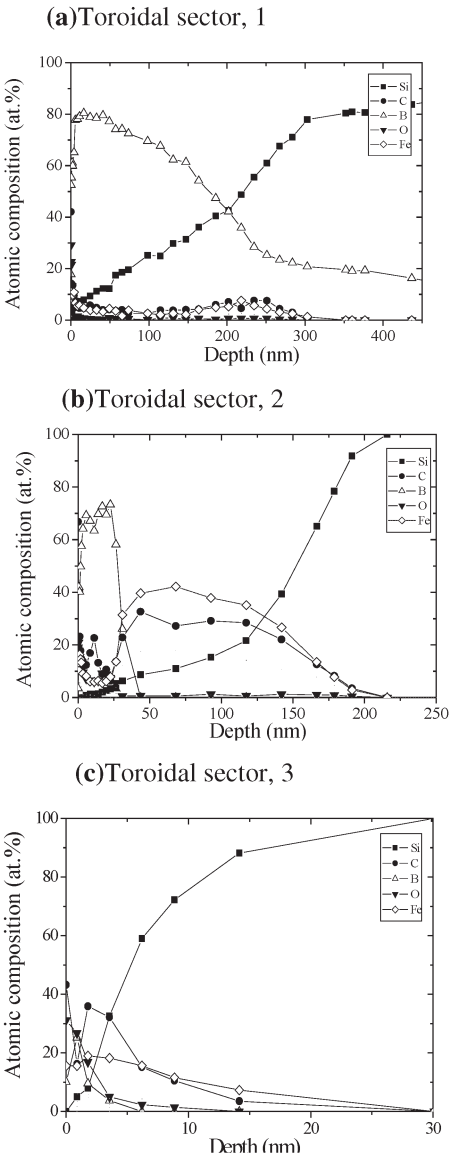

Fig.1 Depth profiles of atomic composition at probes placed at toroidal sectors 1 **(a)**, 2 **(b)** and 3 **(c)**.

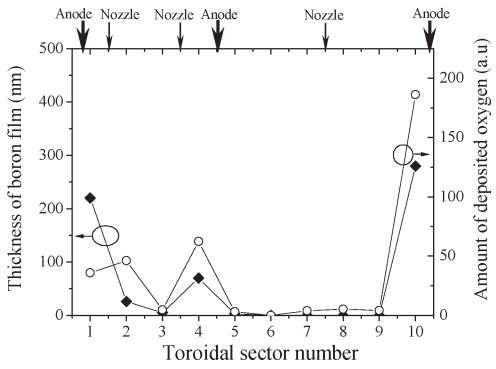

Fig.2 Boron thickness and amount of oxygen retained versus toroidal sector number.

Reference

1) Hino, T., Nobuta, Y. et al, Nucl. Fusion, **44**(2004)496.