

Boronization system (Diborane gas injection system)

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1. Objective

Boronization is carried out for reducing impurities into the plasma vacuum vessel. Diborane (B_2H_6) diluted by helium gasses (10% diborane rate of mixed gasses) are injected during helium glow discharge with a typical operation time of 7 hours. Diborane is resolved into hydrogen and boron by glow discharge, and boron is coated on the plasma facing walls. At present, diborane mixed gasses are injected through three nozzles installed at the three lower ports and about 30% coating area of torus is estimated. Averaged thickness of boron film by one operation of boronization was measured about 50 nm on silicon specimen using the movable sample stage at 4.5L port.

Gas cylinder is placed in the gas cabinet in the LHD room. Remained diborane gas in the gas feeding system is pumped out and exhausted through the specific filter unit in the abatement system.

Boronization is carried out one or two times before or during the experimental campaign.

2. Experimental setup

2.1 Locations

- Gas injection ports : 1.5 L, 3.5 L and 7.5 L
- Vacuum pumping systems with diborane filters : 5.5 L ports (two cryo-pumps are used during boronization only)
- The gas cylinder cabinet and the abatement system locate at east-south side of the LHD hall.
- Two racks with neutron shielding locate at near 4.5 L and 1.5 L pots.

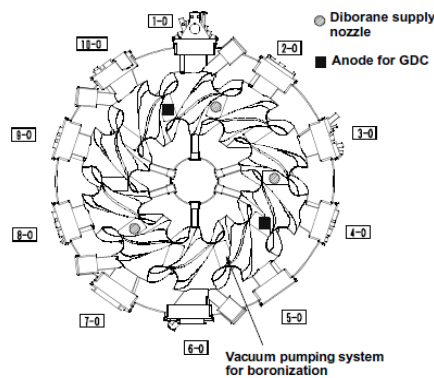


Fig. 1. A schematic drawing of the LHD mid-plane with three diborane supply nozzles and two glow discharge anodes.

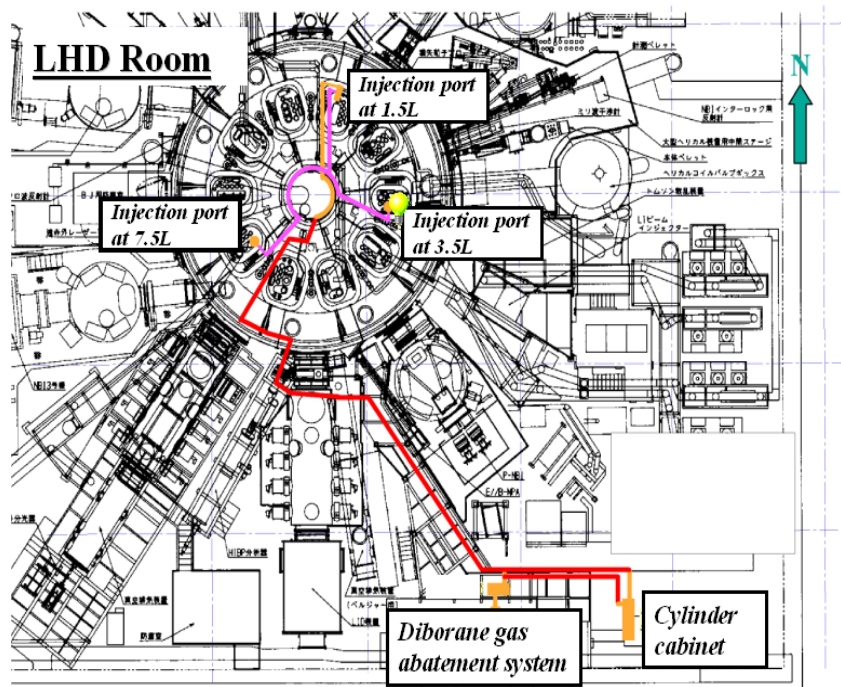


Fig. 2. A schematic drawing of each boronization system in the LHD hall.

3. Operation

- Boronization is carried out one or two times before or during experimental campaign.
- Keep out of LHD main room at 1st floor and B1 floor during boronization

4. Remarks

- License for specific high pressure gas is needed for the main operator of scientists.

References

- [1] K. Nishimura, N. Ashikawa et al., "Effects of Boronization in LHD", J. Plasma Fus. Res. 79 (2003) 1216.
- [2] N. Ashikawa, K. Kizu, K. Nishimura, et al., " Comparison of boronized wall in LHD and JT-60U", J. Nucl. Mater. 363-365 (2007) 1352.