§9. Strain Measurement of Cryogenic Support Structure of LHD

Nishimura, A.

The strain measurement of the cryogenic support structure in the Large Helical Device (LHD) has been conducted from the first cool down in 1998. In the tenth cycle of the plasma experiment in 2006 fiscal year, the measurement with slower ramp-up and ramp- down tests to/from 2.85 T was carried out on October 2006, before the plasma experiments. This report will describe a topic of the strain measurement.

The strain measurement system has not been changed during these 10 years. The details have been reported before [1-3]. The location of the strain gages and the data acquisition system can be referred to these papers.

The strains in toroidal and poloidal directions on inner and outer equators at 2.85 T are summarized in Fig. 1 and 2. In these figures, the horizontal axis shows the sector number of the LHD cryogenic structure, and the vertical axis is the strain. The minimum measurable strain is 2.5 x 10^{-6} strain (με). Since +/- three digits are considered to be the scatter, +/- 7.5 με is the scatter in strain.

At the strain measurement on November 16, 2005, strain gage of HSNE3012, which locates on sector 10 and shows the toroidal direction strain, indicated smaller strain (27.5 με) comparing with the former results (about 42.5 με). Fig. 3 shows the comparison of the data sets on November 16, 2005 and October 4, 2000. Obviously, HSNE3012 showed smaller strain. To investigate the strain behavior, the same drawing was prepared as shown in Fig. 4 and compared with Fig. 3. The recent measurement showed the no clear difference from the data set of October 4, 2000. From his result, it would be concluded that there is no damage on dummy gages for HSNE3012 or gage-leads. At present, the reason is not clear why such degraded result was measured on November 16, 2005. The strain monitoring will be continued and the soundness of the cryogenic structure will be followed.

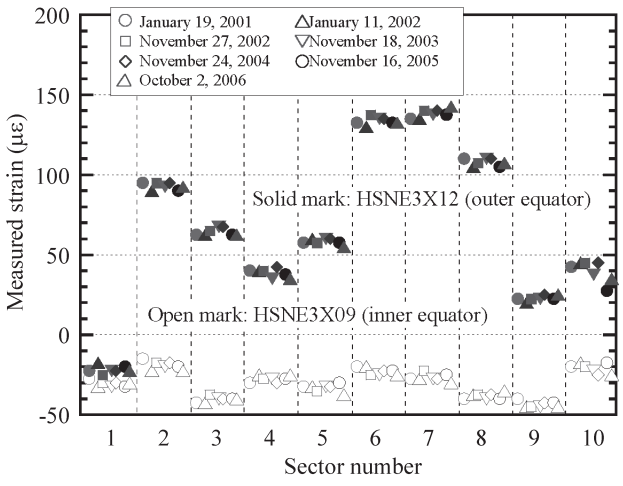

Fig. 1 Change in toroidal direction strain measured.

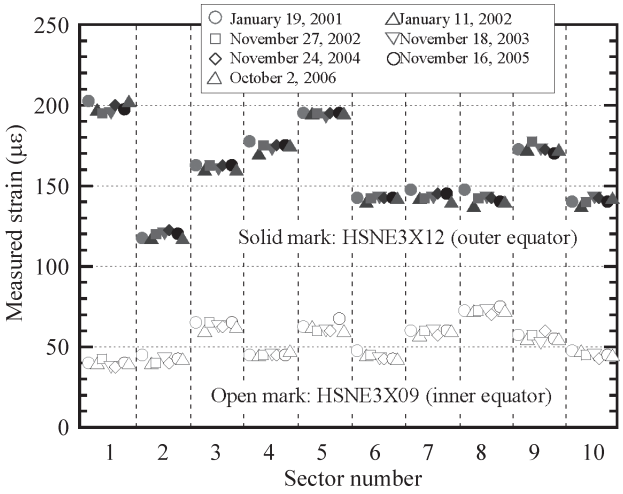

Fig. 2 Change in poloidal direction strain measured.

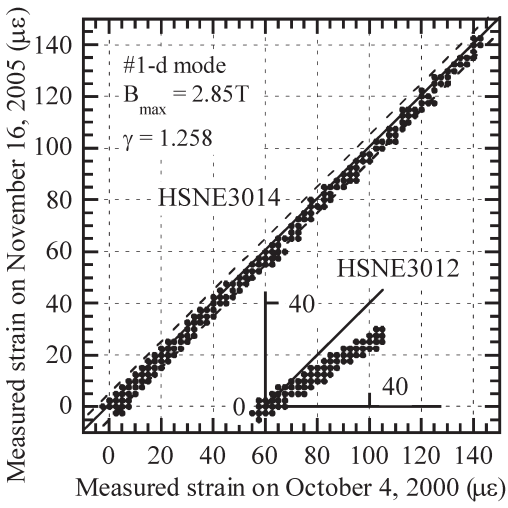

Fig. 3 Comparison of strains (HSNE3014 and 3012) on October 2, 2007 and October 4, 2000.

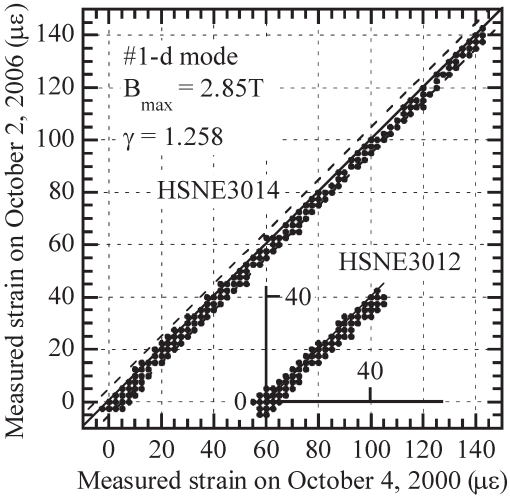

Fig. 4 Comparison of strains (HSNE3014 and 3012) on October 2, 2006 and October 4, 2000.

Reference
1) A. Nishimura et al., Adv. in Cryo. Eng., *45* (2000) 745.
2) A. Nishimura et al., Fusion Eng. Des., *58-59* (2001) 253.
3) A. Nishimura et al., Fusion Eng. Des., *66-68* (2003) 1087.