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Short_Oral_23: Performance of neutral pressure gauges using LaB6-emitters in deuterium plasmas

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Neutral pressure gauges of the ASDEX type [1] have been adapted for stable and reliable operation in magnetic fusion experiments. Neutral pressure gauges using an electron emitting LaB6-crystal aligned with the magnetic field do not experience damage due to the j × B force as observed in neutral pressure gauges with filaments of thoriated tungsten. They were successfully operated in hydrogen in Wendelstein 7-X (W7-X) during OP1.2b in a magnetic field of 1.6-2.2 T at a low heating current of 2.25-2.5 A [2]. Neutral pressure gauges using a crystal emitter present a promising concept for measurements of the neutral gas pressure in a future fusion reactor.

However, there are concerns about its use in the reactor due to the boron. Two LaB6-neutral pressure gauges were installed and tested in the Large Helical Device (LHD). In the campaign 2020/2021, the influence of neutrons on the electron emission properties of LaB6 was studied during two months of deuterium operation yielding 2× 〖10〗 ^18 neutrons in total.
The pressure gauges were installed in different positions, one in the subdivertor region (8I-div) featuring high neutral gas pressures and one near the midplane (9O-mid) in a magnetic field of 2.8T.

Confirming the results from W7-X, both crystals showed stable electron emission during operation in hydrogen and helium and were operated at a low heating current of 1.7 A, allowing for reliable and precise neutral pressure measurements. However, the crystal in position 8I-div experienced a sudden increase of the heating current from 1.7 to 4 A within few plasma discharges during deuterium operation, while the crystal in position 9O-mid remained unaffected. As stability of the emission properties under the influence of neutrons is essential for the use of LaB6-neutral pressure gauges in fusion devices, the degradation of the emission properties in deuterium plasmas is studied in this contribution.

[1] Haas G and Bosch H S 1998 Vacuum 51 39-46
[2] U. Wenzel et al, Rev. Sci. Instrum., 90, 123507 (2019).

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