Contribution ID: **36** Type: **Poster**

Large scale discharge space for penning negative hydrogen ion source

Monday, 8 September 2025 16:30 (1h 30m)

For a high-current negative hydrogen ion source, the discharge power deposited on the electrode surface increases rapidly under high duty factor. At a discharge voltage of 150 V and a discharge current of 50 A, approximately two-thirds of the pulsed discharge power acts on the cathode surface, while about one-third acts on the anode and slit plate surfaces. Such high power density deposition can cause significant sputtering damage and potentially leading to arcing short in the discharge chamber and reducing its lifetime.
Additionally, SRIM calculations reveal that continuous surface sputtering damage makes it difficult to maintain optimal cesium deposition on electrode surface. In later stages of operation, the extracted negative hydrogen beam exhibits a noticeable drop in the pulse flat-top, particularly under high duty factor, where this phenomenon becomes more significant.
To address these issues, the designed discharge chamber features an 8-fold increase in the discharge region volume compared to the original design. By expanding the cathode's discharge surface area while maintaining the same discharge power, the spatial discharge power density is reduced.
The enlarged discharge area minimizes sputtering damage on electrodes and improves cesium deposition. This new discharge chamber has undergone thermal analysis, discharge parameters testing, emittance measurements, and discharge emission spectroscopy to validate its performance.

Primary author: SHENGJIN, LIU (IHEP-CAS)

Co-author: Mr OUYANG, Huafu (IHEP-CAS)

Presenter: SHENGJIN, LIU (IHEP-CAS)

Session Classification: Poster Session

Track Classification: Negative ion sources and sources for fusion facilities