EXPERIMENTAL TEST OF FOUR LITHIUM LIMITERS COMBINATIONS ON T-11M as a protoype of the emitter-collector SYSTEM OF a steady-state tokamak [[1]](#footnote-1)\*)

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The main goal of future tokamaks is the operation in a steady-state regime. An analysis of the literature data from various tokamaks shows that the main limitation to reach it is impurities accumulation in the edge plasma, which limits the discharge duration. A promising solution is the use of lithium as a plasma-facing material.

The lithium program of T-11M tokamak program is focused on solving technological problems of creating a stationary closed lithium circuit in fusion devices. A model of such a circuit was previously proposed, the main elements of which are emitters and collectors of lithium [1]. As part of this program, four different emitter and collector layouts were tested on the T-11M tokamak:

1. The longitudinal lithium limiter was used as both a lithium emitter and a lithium collector (its “hot” aria served as the lithium emitter, and the “cold” ends served as lithium collectors. At the same time, capillary forces could return trapped lithium from the “cold” edges to the “hot” zone);
2. The vertical lithium CPS-limiter served as the lithium emitter and one longitudinal lithium CPS-limiter served as the lithium collector;
3. One longitudinal lithium CPS-limiter was the lithium emitter, and an additional lithium limiter located in the shadow of the first was used as the lithium collector;
4. The vertical lithium CPS-limiter was the lithium emitter, and two symmetric longitudinal lithium CPS-limiters were collectors.

Lithium fluxes in SOL were investigated for each of the above schemes. The indicator of lithium flows at T-11M tokamak is the Mach probe. The radial distribution of the glow on the probe plate and the ion saturation current to the electrodes was studied.

Tests have shown that the last emitter-collector model is the most optimal for the implementation of the closed lithium circulation circuit. First, it was found the decrease in the penetration depth of lithium (characteristic length λ [2]) in SOL from 5 cm to 1.1 cm (during the transition from the first to the fourth scheme). In addition, symmetrization of the magnetic configuration by installing not one but two longitudinal lithium limiters-collectors has shown an effective way of dealing with magnetic islands formed near a single lithium collector.

References

1. S. Mirnov, Tokamak evolution and view to future, Nucl. Fusion. 59 (2018). doi:10.1088/1741-4326/aaee92.
2. Mirnov S.V. J. Nucl. Mater. 390-391 (2009) 876-885
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/AD-Vasina.docx) [↑](#footnote-ref-1)