Comparison of the Lithium capture By Different lithium collectors in the framework of a model of lithium circulation on T-11M Tokamak [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.066

1Shcherbak A., 1Mirnov S., 1Lazarev V., 1Djigailo N., 1Vasina Ya., 1Prishvitsyn A., 1Leshov N., 1Dzhurik A., 1Antonov P., 1Zorin A., 1Otroshchenko V., 2Vertkov A., 2Zharkov M.

1SRC RF TRINITI, Troitsk, Moscow, Russia, [shcherbak@triniti.ru](mailto:shcherbak@triniti.ru)  
2JSC "Red Star", Moscow, Russia

As experiments on tokamaks have shown the use of lithium as possible material of plasma facing components (PFC) is a promising solution to the tokamak first wall problem in future fusion reactors [1]. In addition, the use of lithium in the framework of closed-loop lithium circulation could solve the problem of accumulating erosion products of the first wall of the stationary fusion reactor [2].

Over the years of work on the lithium concept many different combinations for lithium limiters have been investigated as part of the emitter-collector model. As an emitter it was used a horizontal lithium limiter based on capillary-porous systems (CPS), a longitudinal lithium limiter based on the CPS, and a vertical lithium limiter based on the CPS, including a quasi-stationary type, which allows external recharge in breaks between discharges. At the same time, the collection of lithium and the removal of the previously injected lithium was carried out by a ring collector, a collector target, and a longitudinal lithium limiter both “smooth” and based on the CPS.

As part of the work the results of investigations of the joint use of various emitters and collectors on the T-11M tokamak, which were examined earlier, are summarized, and the results of comparing the efficiency of lithium collection with such combinations are also given.

It is shown that the maximum capture of lithium was about 0,25 mg/discharge when using a cryogenic target together with a vertical lithium limiter. At the same time, it was also shown that the cooling of the collector with liquid nitrogen is not necessary for the effective capture of lithium. The introduction of an additional collector (a longitudinal limiter based on the CPS) led to a decrease in lithium collection by 2 times. The capture of lithium with a porous surface formed by a set of wire nets is only 2 times higher in relation to the “smooth” collector. That is, the “smooth” collector had the efficiency of lithium collection about 50% in relation to the incident lithium.

In addition, the work presents new results of the lithium capture by lithium collector depending on the various parameters of the plasma within the framework of the model: vertical emitter and collector target. Studies of lithium collection with a new collector showed dependence on the position of the lithium emitter. It was demonstrated that the collection of lithium increased by 1.5 times with a decrease in the plasma column radius due to the moving the emitter deep into the tokamak chamber.

References

1. I.E. Lyublinski, "Lithium in Power Fusion Reactor", Problems of atomic science and technology, ser. Thermonuclear fusion, 2006, 3, p. 3-26
2. S. Mirnov et al, "Experiments at the T-11M device in support of the tokamak concept with closed Li cycle", Fusion Engineering and Design, 2010, Vol. 85, I. 6, 919-923

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Mu/ru/AS-Shcherbak.docx) [↑](#footnote-ref-1)