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Development of Lithium CPS Based Limiters for Realization of a Concept of Closed Lithium Circulation Loop in Tokamak

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Development of commercially attractive project of a tokamak based fusion neutron source, intended for the progress in fusion power reactor and fission technology, requires the possibility of plasma facing elements (PFE) to steady-state operation under extremely high power loads.
Cooling of tokamak boundary plasma owing to radiation of none fully stripped lithium ions is considered as a promising way for PFE protection. It may be effectively realized when the main part of lithium ions are involved in the closed circuit of migration between plasma and PFE surface. Such power exhaust process may be implemented with the use of in-vessel lithium device based on lithium capillary-pore system (CPS) as plasma-facing material. CPS ensures the PFE self-regeneration during steady-state operation, provides the returning of collected and condensed lithium to emitting zone that prevents lithium accumulation outside the plasma interaction area.
Several types of limiters based on lithium CPS with different ratio of emitting/collecting area and collectors for T-11M tokamak have been developed, created and tested with the aim of experimental substantiation for the concept of lithium closed circulation loop, investigation of lithium behavior in tokamak plasma and estimation of lithium CPS stability under high power flux.
Design and main experimental test results are presented and discussed for horizontal, vertical, longitudinal lithium limiters and also for devices of lithium collection and extraction from the tokamak chamber - ring-type collector, cryogenic target.

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