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Results of KTM Lithium Divertor Model Testing on the Tokamak KTM and Future Plans

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Research program of the lithium divertor module at tokamak KTM includes the following tasks: study of lithium behavior under tokamak's condition and lithium influence on vacuum conditions; study of the processes of plasma interaction with lithium surface; study of lithium influence on plasma parameters; and study of the shielding effects of receiving divertor surface due to re-emitting on lithium. Module of lithium divertor (MLD) on the base of capillary porous systems (CPS) of tokamak KTM (one of 24 tiles of standard graphite divertor) is a box-like element with a channel for coolant flow (eutectic alloy Na-K) and a tank for feeding the receiving surface with lithium. The planned energy flow on the lithium surface under nominal parameters of tokamak KTM (up to 10 MW/m2) is a 700 kJ during 5s discharge. Currently, the KTM facility can only be operated on the capacitors battery, since KTM standard power supply system is not fully connected, thus the decision was made to carry out two consecutive stages of the experiments with uncooled model of lithium divertor (first stage) and then with the cooled one. For the first stage an uncooled (autonomous) module of lithium divertor was used, surface temperature was stabilized by means of heat capacity of the structure with stainless steel-molybdenum heat accumulator; and heating up to the lithium melting point is realized by electric heater. Thermal-hydraulic tests of the Na-K cooled model of lithium divertor were conducted at the auxiliary test-bench, which was manufactured on the basis of standard transport-sluice device of tokamak KTM. Initial temperature of lithium surface (200oC) and its stabilization at the level of up to 550oC during plasma discharge was kept by the coolant flow; coolant temperature and circulation parameters were regulated by the external system for thermo-stabilization (STS). Tests with Na-K coolant proved operability of all the subsystems and elements of the thermo-stabilization systems during all the course of the tests under temperature range from 20 to 200oC. The main results of KTM tokamak experiments with uncooled and cooled MLD are presented in this paper. Future tasks were proposed for the next stage of the KTM "Lithium" Program.

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Author: Ms TAZHIBAYEVA, Irina (Institute of Atomic Energy, National Nuclear Center RK)

Co-authors: Mr VERTKOV, Aleksey (FSUE "Red Star"); Mr AZIZOV, Englen (NRC "Kurchatov institute"); Mr SHAPOVALOV, Gennadiy (Institute of Atomic Energy, National Nuclear Center RK); Mr MAZZITELLI, Giuseppe (ENEA); Mr LYUBLINSKI, Igor (FSUE "Red Star); Mr MIRNOV, Sergey (TRINITI); Mr KULSARTOV, Timur (Institute of Atomic Energy, National Nuclear Center RK); Mr PONKRATOV, Yuri (Institute of Atomic Energy, National Nuclear Center RK)

Presenter: Ms TAZHIBAYEVA, Irina (Institute of Atomic Energy, National Nuclear Center RK)

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