



IAEA FEC 201

Contribution ID: 456

Type: Poster

Lithium and Tungsten Limiters for 3 MW of ECR Plasma Heating in T-10 Tokamak. Design, first results

Friday, 21 October 2016 14:00 (4h 45m)

Application of powerful (up to 3 MW) ECR plasma heating in T-10 tokamak with graphite limiters is pulled down with a problem of the plasma pollution at power input more than 2 MW. The use of carbon based limiters leads to formation of carbon films on a surface of a tokamak chamber wall essentially increasing of impurity flux and hydrogen recycling.

For the solution of these problems the new tungsten and lithium limiters are developed. As it is supposed, application of tungsten as a plasma facing material will allow excluding carbon influx into vacuum chamber. An additional lithium limiter arranged in a shadow of tungsten one will be used as a lithium source for plasma periphery cooling due to a reradiation on lithium that will lead to decrease in power deposition on tungsten limiters.

Parameters and design of limiters are presented. Lithium limiter can move with respect to last closed magnetic surface that allows regulating of incoming power flux and, as consequence, a lithium influx into plasma. Plasma facing surface of a limiter is made of capillary-porous system (CPS) with lithium. Porous matrix of CPS (W felt) provides stability of liquid lithium surface under MHD force effect and an opportunity of its constant renewal due to capillary forces.

The necessary lithium flux from a lithium limiter surface is estimated for maintenance of normal operation mode of tungsten limiters at ECRH power of 3 MW during 400 ms. It is supposed, that Zeff of plasma would not exceed of 2 in this case and about 13 g of lithium deposit will be on the wall for the campaign of 1000 discharges.

Thus, the upgrade of limiters in tokamak T-10 will allow providing of ECR plasma heating with power up to 3 MW at reasonable lithium flux.

Results of first experiments with complex of lithium and tungsten limiters on T-10 tokamak are presented.

Paper Number

EX/P8-37

Country or International Organization

Russian Federation

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Session Classification: Poster 8

Track Classification: EXC - Magnetic Confinement Experiments: Confinement