Observation of plasma processes in SOL region of T-11M tokamak with lithium limiter and target-collector by fast video registration

V.B. Lazarev, A.S. Dzhurik, S.V. Mirnov, A.N. Shcherbak,

SRC RF TRINITI, 108840, Russia, Moscow, Troitsk, Pushkovykh st., 12,

A new high-speed color camera with exposition time up to 4 μs and 300-1000 fps (frames per second) and narrowband interference filters was installed for fast video recording of plasma-surface interaction with a Lithium limiter on the base of capillary-porous system and target-collector in T-11M tokamak vessel. This new technique gave us a possibility to observe many new phenomena near the surface of the lithium limiter especially when viewed fast transient processes and also to observe in SOL region and near the surfaces of the target-collector. So the subject of our study was:

- Determination of radial distribution of Lithium flux in the SOL by neutral Li line emission near the target;
- Effect of MHD instabilities on CPS Lithium limiter and lithium drops generation;
- The distribution of the Lithium Li^+ ion line emission in the plasma boundary and filamention and MHD instability development;
- Generation and evolution of Lithium bubbles on the surface of liquid lithium limiter.

We observed an interesting new phenomenon on the surface of the capillary-porous system with liquid lithium during a stable tokamak discharge, which can be called an analogue of the blistering (fig.1).

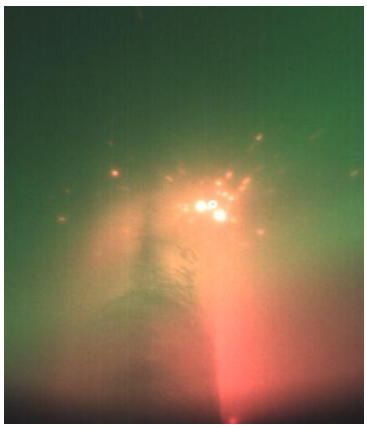

Fig.1. End of bubble evolution - bubble blast on the liquid surface lithium limiter

Video recording of the recombination target-collector (probe) installed in the tokamak vessel with a narrow band optical filter allows to determine the radial profile of the flux of Lithium and Hydrogen ions during time exposition up to 40÷100 μs.

The paper presents the results of the study of tokamak plasma interaction (frame exposure time up to 4 microsecond) with CPS Lithium limiter in a stable stationary phase, unstable regimes with internal disruption and results of processing of the image of the light emission around the probe, i.e. e-folding length for neutral Lithium penetration (λ ~1.3 cm). and e-folding length for Lithium ion flux in SOL region (λ ~2÷3 cm).