First measurements of SOL plasma filaments properties with U-probe in the COMPASS tokamak

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Plasma structures elongated with the magnetic field lines are called plasma filaments, due to their characteristic shape. Filaments have increased density and temperature in comparison to the rest of the edge plasma [1] and conduct electric current along them [2]. Therefore, the filaments carry out energy from plasma and deposit it unequally on the walls of the vacuum vessel. Particularly, large groups of filaments are representing severe danger for the reactor parts exposed to plasma. A complex electrostatic-magnetic probe diagnostics, so-called ‘U-probe’, has been designed, manufactured, and installed on COMPASS. Probe composes of two identical towers. Each tower houses 3 radially spaced sets of 3D coils, triple probe and rake probe. The U-probe measures electric and magnetic properties of the filamentary structures in the plasma scrape-off layer (SOL) with high temporal resolution [3]. The probe head is installed close to divertor region on manipulator allowing adjustment of radial position of the probe on the shot-to-shot basis. The U-probe was operated in different L-mode and H-mode plasmas, even with NBI heating.

This work describes first results of the U-probe measurements concerning the SOL plasma instabilities and current filaments. Propagating filamentary structures has been identified on $V_{\text{float}}$, $I_{\text{sat}}$ and magnetic coil signals. We were able to detect ELMs inner structure as a composition of filaments. Electromagnetic features of these filamentary structures were investigated in detail.

References

