Effect of the pressure gradient in the connection region on the PBM stability

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Abstract

The width of the plasma edge pedestal, formed by the transport barrier and the pressure at the top of the pedestal strongly affect performance of tokamak fusion plasmas. To achieve the plasma of performance target in future devices such as ITER, optimization of the edge pedestal is required. However, achieving the improvement of the pedestal pressure and width still has many difficulties and understanding of pedestal physics remains as a challenge. We have investigated the dependence of pedestal properties such as the pedestal height and the pedestal width on the pressure gradient just inside the pedestal top (ψ_{N}=0.9), α_i, numerically using the parameters of the JET-like plasma (I_p=1.4MA, B_t=1.7T, δ=0.37, β_{N}=2.25) as the basis of the analysis. We used MISHKA [1], an ideal MHD stability code and EPED1 [2], a predictive model of the edge pedestal to analyse the edge stability and predict its structure. As a result, improvement of pedestal properties can be achieved by reducing α_i, which is consistent with experimental findings [3, 4]. Larger Shafranov shift, Δ_{sh}, also improves the pedestal width and height [5, 6]. Positive correlation between poloidal beta and pedestal height [7, 8] is found to be due to stabilization of peeling-ballooning mode (PBM) with Δ_{sh}. From this result, we suggest the possible correlation between pedestal structure and core pressure profile including the effect of Δ_{sh} and α_i.

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