Particle and Power Exhaust for H-mode Operation over 100 Seconds with ITER-like Tungsten Divertor in EAST

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A world record long pulse H-mode operation of 101.2 seconds with H_98=1.1 and a total power injection of 0.3 GJ has been successfully achieved in the EAST tokamak with ITER-like top tungsten (W) divertor, which has steady-state power exhaust capability of 10 MWm^{-2}. The peak temperature of W target saturated at t = 12 s to the value T≈500 ºC and a heat flux ≈3 MWm^{-2} was maintained stably. Great efforts to reduce heat flux and accommodate particle/impurity exhaust simultaneously have been made towards long pulse of 10^2 s time scale. By exploiting the observation of Pfirsch–Schlüter flow direction in the SOL, the Bt direction with Bx∇B away from the W divertor (more particles favor outer target in USN) was adopted along with optimizing the strike point location near the pumping slot, to facilitate particle and impurity exhaust with the top cryo-pump. By tailoring the 3D divertor footprint through edge magnetic topology change, the heat load was dispersed widely and thus peak heat flux and W sputtering was controlled consequently. A fully non-inductive H-mode regime of small ELMs to minimize transient divertor heat load at low pedestal collisionality was developed. In addition, the control of target W sputtering and impurity screening in the divertor region was explored. Extensive lithium coating was employed to lower edge recycling, low-Z impurity content and W sputtering. ECH, high-frequency ELMs and RMP are effectively used for core high-Z impurity expelling.

The upgrade plan and status of EAST bottom divertor from graphite into W to accommodate more challenging particle and power exhaust for steady-state H-mode over 400 s and L-mode operation over 1000 s will also be presented.