

Physics of fast component of deuterium gas jet injection in magnetized plasmas

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Plasma fueling with higher efficiency and deeper injection is crucial to enable fusion power performance requirements at high density for next generation devices such as ITER. Compared to pellet injection fueling method, it penetrates shallower for the fueling methods of supersonic molecular beam injection (SMBI) and gas puffing (GP). SMBI is one method of deuterium gas jet injection. Fast component (FC) of deuterium gas jet injection has been widely observed in the HL-2A experiment for several years but never been simulated and well understood. It is the first time that simulations of FC with trans-neut module of BOUT++ code are well validated with the HL-2A experimental measurements, in this paper. Simulation results are consistent with the experiment. The real HL-2A experimental profiles of plasma density and temperature are applied as the initial profiles in the simulation. Both the spatial and temporal evolution of $D\alpha$ intensity is calculated self-consistently in the simulation by using Atomic Data and Analysis Structure (ADAS) database. The mechanism of FC is revealed. The plasma blocking effect on the FC penetration is also simulated and validated.

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