

Plasma Start-up Experiment using Trapped Particle Configuration in VEST and KSTAR

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A mirror-like trapped particle configuration (TPC) has been applied to the ECH-assisted plasma start-up scenario in VEST by substituting the conventional magnetic field null configuration. An enhanced particle confinement of the pre-ionization plasma as well as the early and fast plasma current initiation have been observed with this TPC start-up scenario in VEST, due to the reduced open field particle loss by particle trapping and the radial/vertical stability of the current channels [1]. A relation is found between the initial poloidal field strength and the pre-ionized plasma density for successful plasma current initiation in various experimental conditions with 10 kW of 2.45 GHz ECH and the electron gun. Based on the result of VEST, TPC has been employed for the ECH-assisted plasma start-up scenario in KSTAR by overlapping the mirror like magnetic field on the conventional null configuration. A drastic enhancement of the open field confinement and the plasma current channel formation is also found with TPC even with the lower magnetic mirror ratio due to the larger aspect ratio of KSTAR compared with VEST. This result indicates that TPC can be used for improved plasma start-up in conventional tokamaks with a particular beneficial effect to the superconducting magnet operation. Moreover, TPC is expected to be helpful for the solenoid free start-up using the outer PF coils only, which generally requires the large pre-ionization power due to large stray fields.

[1] Y.H. An, et al., “Efficient ECH-assisted Plasma Start-up using Trapped Particle Configuration in Versatile Experiment Spherical Torus”, NF, submitted.