

Hybrid injection system of gas and metal pellets for disruption mitigation on HL-2A

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At present, the massive gas injection (MGI) and shattered pellet injection (SPI) techniques are regarded as the primary injection methods for disruption and RE mitigation. Both of them have their own character and can be used in different applications.

In order to combine the advantages of gas injection and pellet injection for avoidance and mitigation of disruptions, a new hybrid injection system, which including an MGI system and Li pellet injection system, had been developed successfully on HL-2A tokamak. It can realize the global simultaneous cooling of the plasma core and boundary. This impurity injection method is more conducive to enhance the mixing effect of impurities. The hybrid injection system is installed at the midplane port on HL-2A. The MGI injector is a kind of pulse valve, which is activated by eddy current. The piston does not make use of any ferromagnetic materials, so the valve can be connected close to the device through flange. The valve with a short response time (0.25 millisecond), and adjustable throughput (1021~1023) allows to meet the requirement of disruption mitigation. The Li pellet injection system has automatic supplying system and turntable adjustment system to adjust the number of Li pellet. The pipeline is connected with the gas outlet of MGI. The pellets freely fall into the pipe, and then are blew into the device by using the MGI injected gas. The injection speed of pellet can be adjusted by MGI injection volume. The Li pellet can be injected with a speed of 200-400 m/s.

Several different injection scenarios were performed using different gases and Li pellet in various amounts on HL-2A.

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