Contribution ID: **97** Type: **Contributed Poster**

Progress of mitigating plasma disruption by the shattered pellet injection in EAST

Tuesday 3 September 2024 13:55 (1 hour)

In the past three years, a shattered pellet injection (SPI) system designed for disruption mitigation on the EAST tokamak was successfully developed and integrated into EAST tokamak in 2022. The SPI system is capable of producing Ne pellets with diameters of ~ 5 mm and lengths ranging from 7 to 15 mm. The material gas consumption is approximately 20, 25, and 30 Pa·m3, respectively, and the estimated pellet flight speed ranges from 100 to 400 m/s. A bend tube with an angle of ~ 20° is installed at the end of the pellet flight pipe to ensure pellet fragmentation [1,2]. During bench testing, the condensation process of pellets was simulated using FLUENT through numerical simulation methods. It was found that the best cold head temperature of Ne pellet condensation was 8-10 K with a condensation zone pressure of 60 mbar and heat sinks temperature of 100 K. Experimental results demonstrate a direct relationship between the durations of thermal quench (TQ) and current quench (CQ) during disruption and the parameters of the pellet. Particularly, with the increase in pellet velocity, the durations of tCQ and tTQ will decrease. The timescales for tCQ were approximately 4-6 ms and for tTQ were approximately 0.05-0.2 ms. In comparison to unmitigated disruptions, the total radiation power significantly increased with the implementation of SPI [3]. Subsequently, we replaced the bend tube with a straight tube, and compared the effects of pellets with different degrees of fragmentation on disruption mitigation. The results indicate that relatively fragmented pellets can achieve shorter cooling times, longer tCQ durations, higher particle assimilation rates, and a more uniform poloidal radiation distribution. Subsequently, comparing the injection effects of pellets in L-Mode and H-Mode, it was observed that the Cooling time in H-Mode was shorter than in L-Mode, and most of the plasma's thermal energy would dissipate before the CQ in SPI. These findings from the EAST experiments serve as a valuable reference for establishing SPI technology as the fundamental approach for disruption mitigation in ITER.

[1] J. Yuan, et al. Fusion Engineering and Design, 191 (2023) 113567.
[2] S.B. Zhao, J.S. Yuan, et al. Journal of Fusion Energy, (2023)42:49.
[3] J. Yuan, et al. Nuclear Fusion, 63 (2023) 106008.

Speaker's title

Mr

Speaker's email address

jingsheng.yuan@ipp.ac.cn

Speaker's Affiliation

Institute of Plasma Physics Chinese Academy of Sciences, Hefei City

Member State or IGO

China, People's Republic

Primary author: YUAN, jingsheng (Institute of Plasma Physics Chinese Academy of Sciences)

Co-authors: Prof. ZUO, Guizhong (Institute of Plasma Physics Chinese Academy of Sciences); Prof. HU, Jiansheng (Institute of Plasma Physics Chinese Academy of Sciences)

Presenter: YUAN, jingsheng (Institute of Plasma Physics Chinese Academy of Sciences)

Session Classification: Posters

Track Classification: Mitigation