Study of the shattered pellet injection on runaway current dissipation in the J-TEXT tokamak

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Runaway electrons (REs), which is created during tokamak disruptions and may lead to runaway current, pose a threat to the reliable operation of future large tokamaks[1]. The SPI technology has been regarded as a primary method to mitigate the runaway current [2]. There are quasi symmetric dual SPI systems which have been developed to in J-TEXT used for disruption mitigation and runaway current dissipation. A series of experiments about runaway current dissipation by these two SPI systems have been carried out. The preliminary experimental results show that there is a positive correlation between the dissipation efficiency and the pellet velocity. Compared to Ar MGI, when the Ar pellet velocity is about 200 m/s, the runaway current dissipation rate is only about 12 MA/s, which is far lower than 22 MA/s in MGI shot. This difference may be caused by the low temperature of the runaway current in the J-TEXT, which makes it difficult to completely melt the fragments. As the pellet velocity increasing to 300 m/s, the dissipation rate increases to about 20 MA/s, which shows the Ar SPI has a similar dissipation effect than MGI. The similar results also have been found in Ne SPI experiments. With the increase of pellet velocity, the fragments are broken into smaller pieces. The larger contact area between the fragments and the runaway current makes the ablation more complete, thus improving the dissipation effect, which is proved by the increase of impurity assimilation rate.

[1] Rosenbluth M.N. and Putvinski S.V. 1997 *Nucl. Fusion* 37 1355

[2] Lehnen M, et at., 2018 R and D for reliable disruption mitigation in ITER *IAEA Fusion Conf.* (Gandhinagar, India, 22–27 October 2018)