Disruption mitigation by shattered pellet injection on J-TEXT

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ABSTRACT

- A dual SPIs system has been developed in J-TEXT. The kind and reaching time of first and second pellets can be determined by pellet penetration time, SXR and fast camera. The experiments about plasma rapid shutdown by dual SPIs shows that dual SPIs can accelerate the plasma current decay at CQ. The CQ rate of dual SPIs can exceed the 70 MA/s. The localized thermal radiation is reduced by dual SPIs. And the toroidal radiation asymmetry has been improved by dual SPIs.

BACKGROUND

- Shattered pellet injection (SPI) has been a primary disruption mitigation method for ITER [1].
- However, single pellet is not enough to increase the electron density for large Tokamak devices [2].
- Dual SPI systems has been developed in J-TEXT to prove the reliability of multi-SPIs [3].

RESULTS

A. Characteristics of single pellet injection

<table>
<thead>
<tr>
<th>Parameter of dual SPIs</th>
<th>Ar</th>
<th>Ne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Propellant gas</td>
<td>Ar</td>
<td>He</td>
</tr>
<tr>
<td>Temperature (K)</td>
<td>60</td>
<td>15</td>
</tr>
<tr>
<td>Diameter (mm)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>2-8</td>
<td>2-8</td>
</tr>
<tr>
<td>Velocity (m/s)</td>
<td>150-300</td>
<td>150-350</td>
</tr>
</tbody>
</table>

B. Fast shutdown by dual SPIs

- The dual SPIs can accelerate the plasma current decay at CQ;
- The CQ rate of dual SPIs can exceed the 70 MA/s of single Ne SPI.
- The localized thermal radiation is reduced by dual SPIs.
- The toroidal and poloidal radiation asymmetry has been improved by dual SPIs.

C. Influence on CQ and thermal radiation

- The arrival time difference ~ 1.8 ms.
- The photos were taken by fast camera with Ar II filter.

CONCLUSION

- The dual SPIs system has been developed on J-TEXT.
- The dual SPIs can accelerate the plasma current decay at CQ, and the CQ rate exceeds the 70 MA/s of Ne SPI.
- The dual SPIs can reduce the localized thermal radiation and improve the radiation asymmetry.

REFERENCES