

P2.1069 Investigation of TESPEL cloud dynamics in Wendelstein 7-X stellarator

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See full abstract here

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.1069.pdf>

A Tracer-Encapsulated Solid Pellet (TESPEL) injection system was recently developed and installed on the Wendelstein 7-X (W7-X) stellarator. A tracer impurity (typically high-Z materials like iron or tungsten) for impurity transport investigations is embedded into a polystyrene polymer (C₈H₈)_n sphere with a diameter of <1 mm. TESPEL is injected radially from the low-field side of the stellarator by a gas gun. Among other diagnostics, a fast framing camera looking from behind the TESPEL injection port was also installed in order to investigate the polystyrene ablation, cloud formation, expansion and drift processes. Wavelength selection by interference filters was used to separate certain ionic species (C I, C III and H I). The temporal resolution of the system is up to 500 kHz. The observation view allows to determine the vertical and poloidal movement of the TESPEL and to investigate the radiation distribution of the polystyrene cloud along and perpendicular to the magnetic field lines. The ablation rate of the polystyrene is similar to that of the cryogenic hydrogen pellet therefore it is not unexpected that similar features could be identified. It was observed that the TESPEL follows the designated radial trajectory, no vertical and poloidal deflection was seen. The pellet cloud distribution has a quasiperiodic fluctuation which is associated with the vertical detachment (drift) of the ionised cloud. First the pellet cloud expands parallel to the magnetic field for about 10 μs. Next, the ionised part of the cloud moves vertically (typically upward) detaching itself from the pellet. This takes about 10 μs. Finally, these processes are repeated. When the cloud is detached only a considerably reduced, and probably neutral, cloud remains around the pellet. At this time the shielding effect of the cloud is reduced thereby resulting in higher ablation and therefore more intense radiation. This contribution presents a detailed study of the cloud formation and drift based on the fast framing recordings of C I, C III and H I radiation distribution.

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