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14.2 Tracer-Encapsulated Solid Pellet (TESPEL) Injection System for Wendelstein 7-X

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In magnetically confined fusion reactors, heavy impurity ions released by plasma wall interaction and entering the plasma may lead to fuel dilution and degradation of plasma performance by enhanced radiation losses. Therefore, plasma regimes avoiding large impurity influx and impurity accumulation, have to be explored in order to ensure stationary plasma operation. Impurity confinement is mainly determined by transport mechanisms in the core plasma. For W7-X, the island divertor is expected to screen external impurity sources in the scrape-off layer at higher densities effectively. However, the unique feature of Tracer-Encapsulated Solid Pellet (TESPEL) injection, releasing impurities at a well localized radial position directly in the core plasma enables investigating such transport mechanisms. This paper reports on the detailed design and achieved performance parameters of a completely new tracer-encapsulated solid pellet (TESPEL) injection system, which has been designed by NIFS, Japan and is currently being assembled at IPP, Germany, for the Wendelstein 7-X stellarator.

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