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P2.105 Erosion and deposition investigations on Wendelstein 7-X first wall components for the first operation phase in divertor configuration

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In the Stellarator Wendelstein 7-X with its twisted 3D magnetic field geometry, studies of material migration with respect to first wall components becomes very important in view of the envisioned long-pulse operation. A variety of erosion/deposition probes were installed on graphite plasma-facing components exposed at three different nominal heat load levels between 0.1 and 10 MW/m². At the location of the highest heat loads, 18 exchangeable divertor target elements were coated with C/Mo marker layers on graphite and for the lower loads, 44 Si-wafer probes were installed. An extensive array of >30000 probes in form of amorphous carbon coated Ti-Zr-Mo screw heads was installed around the torus capable to withstand ≤ 0.5 MW/m².

After the first successful operation phase in divertor configuration (OP1.2a), all the probes at higher and lower load levels were removed, out of 30000 screws about 350 have been exchanged at selective locations along the toroidal and poloidal directions. The removed probes are being currently analysed by different methods: Rutherford backscattering, scanning electron microscopy, laser-induced breakdown spectroscopy, nuclear reaction analysis etc. The deposition profile of carbon layers along the whole vessel wall is being measured using a colour analyser. A complex pattern of erosion and deposition zones can be identified optically with coloured deposition layers after about 60 plasma minutes excluding the glow discharge cleaning. First tests with tungsten were performed on short samples using mid-plane manipulator. Further analysis of the composition will be presented.

For the operation phase 1.2b a new set of probes are being installed, 16 Si-wafer probes are being replaced with 12 material probes providing directionality information for the deposited materials and 4 cavity probes. Further tests with tungsten will be performed by replacing 21 heat shield graphite tiles with tungsten coated ones and additionally coating 3 tiles on an exchangeable target element.

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