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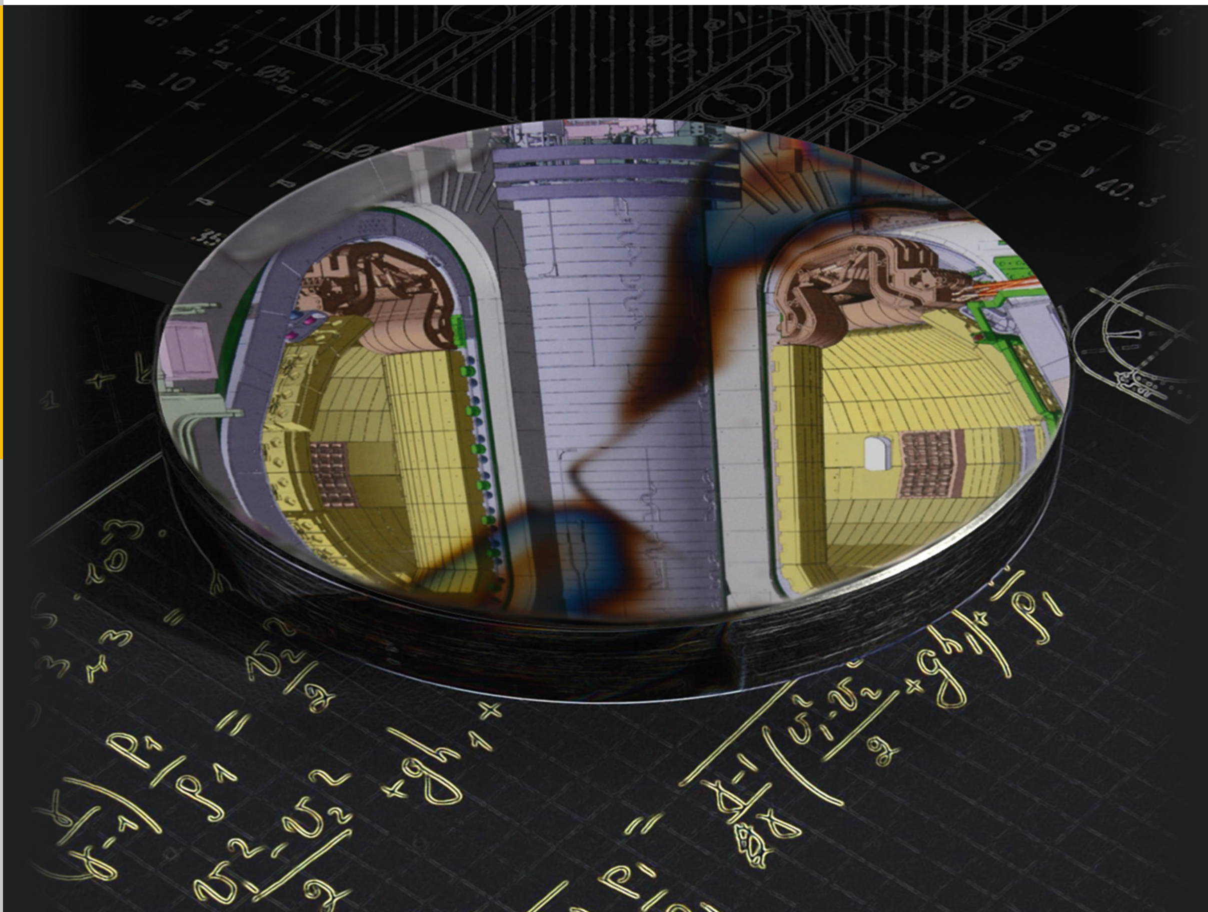

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Table of contents

assumption implies that the samples that are installed on the limiter as shown in Figure 5.5 face the same plasma, i.e. particles with the same energy and flux arriving at the surface along the line corresponding to a given radial coordinate. This also means that the balance of erosion and deposition on the sample holder should be the same for those locations leading to a transition from erosion to deposition zone in form of a horizontal line (poloidally) on the limiter surface. However, observing the inclined deposition pattern on the mirror holder, the poloidal inhomogeneity is visible (Figure 5.5a), and it may be concluded that the upper part of the Mo-coated mirror must have been exposed under conditions similar to those at the center of the Rh-coated mirror, which can be attributed to a variation of plasma parameters within a radial distance of 1 - 2 mm. The variation of plasma parameters can be, in turn, attributed to the finite poloidal radius of the plasma in TEXTOR.

Table 6.1. Average plasma parameters, decay lengths and accumulated particle fluences in mirror experiments.

	Low-fluence	High-fluence	Large SC Mo	Periscope
n_e (m^{-3})	2.6×10^{18}	3.6×10^{18}	$1.4 / 2.4 \times 10^{18}$	1.5×10^{18}
T_e (eV)	36	31	14 / 20	25
λ_n (mm)	24.1	26.6	26.6	39
λ_T (mm)	28.4	30.2	30.2	26.6
λ_Γ (mm)	17.0	18.5	18.5	22.5
λ_Q (mm)	10.6	11.5	11.5	12.2
No. of discharges	24	36	37	He: 22, D: 43
Fluence, Φ (m^{-2})	4.3×10^{24}	10.1×10^{24}	$2.8 / 5.9 \times 10^{24}$	He: 5.2×10^{24}, D: 9.1×10^{24}

6.1.2 Effect of gas feeding on plasma parameters

The experiments with different gases blown in the Periscope system, described in section 5.2, allow marking out the physical processes playing the major role in the mirror protection from deposition. The two gases used for this purpose are helium and deuterium, which have different physical and chemical properties. Helium is a non-reactive gas with the ionization energy of 24.6 eV such that the energy transfer with plasma ions (D^+) happens mostly in elastic collisions. Deuterium is a molecular gas with the dissociation energy of D_2 molecules of 4.56 eV. Ionization of D_2 molecules happens at 15.1 eV, and D atoms are ionized at 13.6 eV. In this case the energy transfer with D^+ plasma ions has a resonant character and is dominated by the charge-exchange process. Considering physical sputtering of deposited layers, the threshold energy for sputtering of carbon by impinging He ions is 19.12 eV. In the case of the D_2 gas injection, the rather low dissociation energy of D_2 molecules favours their prompt dissociation. To induce physical sputtering, D atoms have to be ionized and gain energy above 27.7 eV. Due to a lower mass physical sputtering in the case of deuterium is weaker than that for helium. In particular, at an ion energy of 50 eV the sputtering yield of carbon by He is about 4.8×10^{-3}, while it is 1.9×10^{-3} for the case of D impact [Eckstein 2011]. However, in addition to physical sputtering deuterium atoms and ions induce chemical erosion of deposited a-C:D layers. Considering the experimental results (section 5.2.3), namely the fact that the layer pre-deposited on the 1st mirror was not reduced in the case of the He gas injection, allows the conclusion that physical sputtering does not play a substantial role in the mirror protection from deposition under conditions of these particular experiments in TEXTOR. On the contrary, the experiments with the D_2 gas injection

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