ESTIMATING THE NEUTRAL PARTICLE FLUXES CRITICAL FOR THE ITER OPTICAL DIAGNOSTICS

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Erosion due to fast particles and impurity deposition are severe limiting factors for the life-time of the first mirrors of the ITER optical diagnostics [1]. The mirrors will be installed in protecting structures which prevent their direct plasma exposure. However, significant erosion and deposition can still be caused by the neutral particles escaping from the plasma across the magnetic field. In this paper the fluxes, energy and angular spectra of these neutral particles are estimated at relevant locations in the ITER vessel using the kinetic Monte-Carlo transport code EIRENE [2].

Plasma parameters in the scrape-off-layer (SOL) are taken from the series of self-consistent (between the plasma and neutral gas) simulations of the ITER operational scenarios performed with the B2-EIRENE (SOLPS 4.3) code [3]. The simulations were carried out for the new reference magnetic configuration and divertor design F57, full-power ITER discharges with the radiation fraction of 0.4-0.7 and partially detached divertor. Only steady-state plasma is modeled: that is, either assuming mitigated ELMs or for the phase between ELMs, considering only time-averaged intermittent transport.

It is expected that mirrors made of refractory metals (e.g. Mo) will undergo sputtering mainly due to particles with energies exceeding ~1 keV which originate from charge-exchange and elastic collisions in the hot core plasma. Therefore, the computational domain of the Monte-Carlo code covers the entire core plus SOL plasma. Plasma parameters in the core region are taken from 1D transport simulations. Calculations made with "handbook" values of the physical sputtering yields indicate that erosion do to He bombardment is negligible compared to that due to DT. However, the incident energy spectra and fluxes of He provided here may still be useful to estimate the effect of the He induced blistering.

Previous estimates [4] have shown that for the conditions of the ITER main chamber it is not the erosion but the impurity (Be, C) deposition that will most likely cause the fastest degradation of the optical properties of the mirrors. Distinct from the erosion estimates, the calculations made for the first wall which do not take into account the diagnostic duct do not yield even the upper boundary of the net deposition rate (deposition minus erosion): reliable estimate should consider the deposition of impurities on the duct wall and their subsequent re-erosion. As a first step to provide such an estimate calculations performed for a "generic" shape of the diagnostic duct (straight tube) will be presented.

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