J Astrophys Aerospace Technol 2018, Volume 6
DOI: 10.4172/2329-6542-C3-024

4th International Conference on
ATOMIC AND NUCLEAR PHYSICS
October 26-27, 2018 | Boston, USA

Erosion and impurity deposition on diagnostic installations in a fusion reactor

Mikhail Z Tokar
Research Center Jülich, Germany

By reaching the vessel wall of a fusion reactor, charged plasma particles, electrons and ions, are recombined into neutral molecules and atoms of hydrogen isotopes. These species recycle back into the plasma volume and participate, in particular, in charge-exchange *(cx)* collisions with ions. As a result hot atoms with chaotically directed velocities are generated. Some of these flee into opening in the vessel wall for ducts guiding to diagnostic installations e.g., first mirrors for optical observations. Consequently, the mirror surface is destroyed. Besides, cx-atoms erode the walls both of the reactor vessel and of the diagnostic duct. The impurity particles released may migrate to the mirror surface and be deposited there. Both erosion and impurity deposition decline the reflectivity of mirrors. A theoretical model for processes outlined above is formulated, including a two-dimensional kinetic description of relevant neutral species in the vicinity of the duct opening in the vessel, an assessment of the erosion intensity of the vessel and duct walls and mirror surface by hot atoms, estimates for influxes of the vessel armor material into the duct and a consideration of the migration of impurity atoms along the duct towards the mirror surface. Calculations for the conditions predicted for a fusion reactor like DEMO are done and the erosion of and impurity deposition rates on first mirrors of Mo are assessed versus such input parameters as the duct radius, the distance from the opening to the mirror, the density ng of the working gas in the duct, the probabilities for impurity sticking to the duct wall and mirror surface. It is demonstrated that by increasing ng up to a level of $2*10^{19}m^{-3}$ one can reduce the mirror sputtering to the target level of 1nm per full power year or all input parameters considered the erosion rate of impurities deposited at the mirror significantly exceeds the deposition rate. Thus, no formation of impurity precipitations on the mirror surface has to be expected.

m.tokar@fz-juelich.de