Plasma-wall interaction, transport of impurities and erosion/deposition are major issues in fusion research. Understanding of these processes is indispensable for a fusion reactor and only can be achieved in a combined effort of experiment and modelling. The high-Z material tungsten is a preferred material for plasma facing components due to its high melting point and relatively low sputtering. Moreover, its beneficial ability of prompt deposition can lower the net erosion. However, deposited tungsten ions can further sputter material, which can lead to runaway sputtering if the self-sputtering yield is larger than one.

The present contribution gives an overview of main questions within the field of plasma-wall interaction in fusion research and according modelling. The issue of prompt tungsten deposition will be treated in detail by using the 3D code ERO considering Particle-In-Cell modelling to account for sheath effects close to the wall. ERO treats plasma-wall interaction processes like sputtering, reflection and deposition as well as impurity transport, taking into account friction, Lorentz force and cross field diffusion. Also atomic processes like ionisation, recombination and light emission are included. The prompt tungsten deposition is modelled for various plasma conditions and the possible effect of runaway sputtering is studied. It is seen that the amount of prompt deposition can vary between 0% for small electron densities around 1E12 cm⁻³ and temperatures in the eV range and 100% for high densities of 1E15 cm⁻³ and temperatures around 10 eV. For the steady state conditions expected around the strike points in ITER the amount of promptly deposited tungsten is modelled to be about 60%. The contribution of intra-ELM and inter-ELM plasma phase to the net erosion will be addressed. Simulations for JET-ILW suggest that the net erosion is dominated by the ELM-phase although the prompt deposition within ELM (about 95%) is rather large compared to the phases in between ELMs (50%). However, the gross erosion is much larger during ELMs due to the high impact energy of deuterium ions. The results will be compared with observations of tungsten erosion in JET-ILW.