Interaction of sheaths in multicomponent plasma via computer modelling

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Nowadays, computer models play an important role in plasma science investigation. They help to correctly interpret experimental data and develop new theories of plasma behaviour in specific conditions or near immersed solids with complex geometries. Especially, in the area of low temperature plasma computer models are indispensable since this kind of plasma is non-equilibrium system; therefore, theoretical approach is usually very complicated.

In our contribution we used the self-consistent particle simulation which is suitable computer modelling technique for low temperature plasma. Our 2D Particle-in-cell code with scattering process modelling is capable of simulating the creation of sheath near solids immersed in plasmas of different parameters (e.g. plasma pressure, composition, etc.). Molecular dynamics method together with Monte Carlo treatment of collisions that are employed in our model are able to correctly resolve velocity distribution functions of charged particles in examined plasma and finally to obtain reasonably accurate results.

One of the topics where the particle computer models can bring valuable results is the issue of mutual interaction of several plasma sheaths. Usually, experimenters try to avoid the interaction of sheath layer around Langmuir probes immersed in plasma with sheaths around nearby solids because it complicates the interpretation of obtained results. But there is wide range of questions what will happen if the sheath of Langmuir probe will interact with another sheath. How will the measurement of IV characteristics be modified? Which effects will come into play mostly? Some computational studies of the plasma sheaths interaction have already been done [1]. We tried to extend them into the conditions of multicomponent plasma and observe the dependence of various physical quantities on the electronegativity of plasma during the interaction of sheaths. Mainly, we were interested in the potential distribution, number density of charged particles and their fluxes in the computational domain. We also quantified the effects of plasma sheaths interaction on the IV characteristics measurement.