Abstract

The aim of the thesis is to examine plasma-wall interaction using computer modeling. Tokamak-relevant plasma conditions are simulated using the particle-in-cell model family SPICE working in three or two dimensions. SPICE model was upgraded with a parallel Poisson equation solver and a heat equation solver module. Plasma simulation aimed at synthetic Langmuir probe measurements were performed. First set considered a flush-mounted probe and the effect of variable magnetic field angle was studied with aim to compare existing probe data evaluation techniques and assess their operational space, in which the plasma parameters estimation via fit to the current-voltage characteristic is accurate. Second simulation set studied a protruding probe pin. Effective collecting area of such probe was investigated with intentions of density measurement collection. This area was found to be influenced by a combination of two factors. First, the density dampening inside the magnetic pre-sheath of the probe head, and the second, the extension of the area caused by Larmor rotation. A comparison with experimental results obtained at COMPASS tokamak was was performed, confirming these results.

Keywords

Langmuir probe, simulation, particle-in-cell, tokamak, Poisson equation, COMPASS