Influence of Magnetic Field on Dust Charge in Divertor Plasma

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Investigation of the dust effect in fusion devices has become an important research area in the implementation of large-scale fusion plasma experiments [1-3]. Determination of the mechanism of dust production, study of dust-plasma interaction and interaction of dust with surface of fusion reactor, dust transport, impact assessment of dust on the characteristics of the reactor and the safety of fusion devices - all these questions are very relevant.

The main goal of this work is the study of influence by magnetic field on the charge of dust particles in the divertor plasma. Effect of magnetic field on the charge of dust particles in the divertor plasma can play a significant role in shaping the edge plasma, since the dust transport, their evaporation determines the composition of the edge plasma, and, accordingly, its transport properties.

In [4, 5] the charge of the dust with the magnetic field in the approximation of the orbit motion limited theory (OML) were calculated. In this paper, the charge of dust is determined by particle in cell method, taking into account collisions of ions with atoms, carried out using the Monte Carlo method.

It is considered the cube in the centre of which was placed a neutral macro particle (dust grain) with fixed size and an infinitely big mass that absorbs all incident charged plasma particles.

The initial distribution of electrons and ions are chosen with equal probability for the volume of a cube, the velocity distribution is assumed Maxwellian. Boundary conditions are relied so to maintain the set on the boundary conditions - all ions and electrons are reflected with the corresponding distribution functions at infinity. Further the motion equations with the magnetic field for electrons and ions are solved.

The calculations were performed for the following parameters of the divertor plasma [6]: density of electrons and ions are equal to 1014 cm-3, the electron temperature is 3 eV, and the ion - 0.7 eV. The charges of dust particles with a radius of 0.5; 1; 2 μm and values of the magnetic field in the range 10 ÷ 106 Gauss were calculated.

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