Monte Carlo Calculations on Energy Deposition by Magnetized Electrons into Divertor Plates Shielded by Inhomogeneous Carbon Plasma

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To evaluate the erosion rate of divertor plates under the action of an intense magnetized plasma flux, it is necessary to know the distribution of the energy deposition versus the depth of an inhomogeneous plasma layer and the fraction of energy deposited into the bulk target.. This fraction depends strongly on the properties of the carbon plasma shield in front of the divertor. A Monte Carlo model for description of the transport of Maxwellian plasma electrons in solids and in homogeneous and inhomogeneous plasmas is developed. Using this model, the energy deposition profiles into the divertor plasma shield with density, temperature and magnetic field gradients and into graphite plates shielded by this plasma have been calculated. The following two cases were investigated: a) the magnetic field is constant and the inclination angle of the magnetic field lines with the plasma surface is 5° b) there is a magnetic field gradient along the impact direction of the plasma electrons (diamagnetic effect of the plasma shield).The calculated energy deposition into such a complex target shows two peaks. The first peak is a result of the energy deposition of electrons into the shock wave of the plasma shield. The second peak is associated with the energy deposition into the bulk graphite target. The distribution of the energy deposition depends on the longitudinal kinetic energy of the electrons before their entrance into the plasma shield. The second peak of the energy deposition in the bulk graphite is close to the surface and range shortening occurs for a decrease of the longitudinal kinetic energy. For Maxwellian electrons of temperature of 10 keV and impact angle of 5°. The distance of energy deposition in the bulk graphite target shielded by a layer of inhomogeneous carbon plasma is up to 30 μm. Assuming additionally a diamagnetic effect of the plasma shield with magnetic field frozen in at the target the distance of energy deposition increases up to 50 μm in the bulk target.