

P2.1104 Pulse shape dependence of vapor shielding efficiency during transient loads

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See the full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P2.1104.pdf>

Erosion of wall materials during transient events is a large concern for ITER and future fusion devices with high external heat power. The extensive heat loads cause melting, vaporization, and ablation of wall materials. It is known that the vapor shielding can be an inherent protection mechanism for the wall erosion during the extensive heat loads. The generated vapor from surface strongly interacts with the incoming plasma loads and dissipates the plasma energy to elsewhere. The phenomenon has been studied by fluid-based models, but kinetic behaviors of the multi-component plasma during the transient event accompanied with the wall erosion was not analyzed. The authors develop a particle-in-cell (PIC) simulation code [1, 2], called PIXY, and applies it to simulation of the vapor shielding at fusion devices. During the vapor shielding, the number of surface-ejected particles is a strong function of the surface temperature and significantly spreads over a very wide range. Thus, in order to treat the sufficient numbers of numerical super-particles, a weighted particle model is applied. Using the weighted particle code, previous study [2] investigated wall erosion under a rectangular pulse shape with a fixed time duration. However, in the transient heat loads, it is known that the erosion is strongly dependent on the pulse shape [3]. Thus, pulse shape dependence of wall erosion including vapor shielding is studied using the weighted particle code. Three triangle pulse shapes with a fixed energy flux, peak heat flux, and pulse duration are examined. The results are compared with rectangle pulse shapes with the same energy flux but a different peak heat flux and time duration. Erosion amounts and vapor shielding efficiency are evaluated and compared between these pulse shapes.

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