Numerical simulation of melt metal layer motion under impact of an intense plasma streams

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Armour materials of ITER divertor and the first wall will be subjected to intense plasma-thermal impacts during the reactor operation. It is expected that extreme loads on the plasma-facing materials will occur during transient processes (plasma disruptions and ELMs) [1]. Erosion processes will reduce lifetime of the reactor significantly and therefore require investigation. Previous QSPA-T experiments demonstrated that the erosion of armour occurs mostly due to movement of melt surface layer [2]. So far there is no full understanding of underlying physical processes due to complexity of this phenomenon. In this work computational model presented, which describes the behavior of a metal under the action of an intense plasma stream. The model is based on a system of strongly coupled heat transfer and hydrodynamics equations. Movement of the melted metal is calculated in the presence of an external magnetic field. Displacement and wave structure of melted layer are obtained at a range of plasma heat loads and compared with experiment. The work is supported by contract H.4a.241.19.22.1123 dated 14.02.2022.

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