Contribution ID: **3570** Type: **not specified**

P5.1030 0D model of vapour shielding and its application for liquid material targets

Friday, 12 July 2019 14:00 (2 hours)

See full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1030.pdf

Intense heat loads on the plasma-facing components (PFC) of tokamaks during transient events such as Type I ELMs and disruptions may result in melting and evaporation of the materials. The evaporated impurity cloud ionizes and serves as a shield reducing heat loads on the PFC. Since accurate estimates of the power fluxes to the divertor targets are crucial for ITER and future DEMO design, shielding physics is intensively studied on linear plasma devices such as Magnum-PSI and QSPA. Moreover, development of liquid metal divertor concepts for tokamaks as a possible alternative to a fully metallic first wall also requires taking the shielding effects into account.
Experiments with Li and Sn aimed to study liquid metal response to the extreme plasma heat loads and associated shielding effects are conducted extensively on Magnum-PSI and Pilot-PSI devices [1]. However, a consistent theory of the vapour shielding is yet to be developed. In this work we present a new 0D model of shielding including an extensive set of processes involved. Singly ionized species of background plasma and evaporated material are considered. We take into account elastic collisions between all the participating particles, volumetric ionization and recombination, radiation, and plasma-surface interaction processes. The surface temperature evaluation is governed by 1D thermal conductivity equation.
The model is applied to experiments on Sn and Li vapour shielding [1]. The role of different processes controlling the target surface temperature is discussed. Stability of steadysate solution with respect to perturbations of vapour density and temperature is investigated. Estimations of Li vapour shielding in fusion relevant case of hydrogen plasma are given.

This work is supported by Russian Foundation for Basic Research grant 18-3220114\18.

[1] T.W. Morgan, P. Rindt et al. Plasma Physics and Controlled Fusion, V. 60, 2017, P. 014025.

Presenter: MARENKOV, E. (EPS 2019)

Session Classification: Poster P5