Self-consistent simulation of Magnum-PSI target in SOLPS-ITER with a Finite Element Wall model

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Accurate simulation of the plasma and neutral dynamics in front of Magnum-PSI's target [1] is of uttermost importance to understand the complex physical processes taking place in divertors with huge heat and particle loads as those expected at ITER. These simulations can aid to understand relevant Atomic & Molecular (A&M) processes taking place near the target [2]. Moreover, the addition of liquid metal (Li or Sn) targets, currently being analysed in Magnum-PSI, creates a much more complex scenario. Therefore, including the evolution of the target properties in a self-consistent way is of uttermost importance. This includes the surface temperature, evaporation flux of liquid metals, sputtering, outgassing and other relevant processes arising from the interaction of high temperature plasma and neutrals with the target.

A Finite Element wall model [3] to describe the target temperature evolution is currently being developed to work in combination with the well-known edge plasma code SOLPS-ITER [4, 5]. This strategy allows for an in-depth comparison with experimental data, which is useful for the validation of the code and also to translate the relevant A&M processes in the device to other machines.

In this work, the surface temperature of a simple tungsten target obtained self-consistently with the simulation of plasma and neutrals in Magnum-PSI is presented and its effects in the recycling of ions at the target is analysed. Simulations are compared with experimental measurements from Thompson Scattering near the target and temperatures of the target surface.

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