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Symmetric multi-component diffusion modeling for Magnum PSI

KIM PEERENBOOM, JAN VAN DIJK, Eindhoven University of Technology, WIM GOEDHEER, FOM-Institute for Plasma Physics Rijnhuizen, JOOST VAN DER MULLEN, Eindhoven University of Technology — Magnum PSI is a linear plasma generator for studying plasma surface interaction in conditions as expected in the ITER divertor. In Magnum PSI, the diffusive fluxes do not follow the simple Fick law for diffusion, due to coupling of the fluxes between species and directions, and ambipolar and magnetic fields. Instead they are described by the Stefan-Maxwell equations. In our contribution, we will address the numerical issues associated with solving the Stefan-Maxwell equations and the resulting set of continuity equations for the species. In particular, we will present a symmetric approach where all species are treated as independent unknowns and no species are singled out in order to account for mass and charge conservation. Modeling results of Magnum PSI using this approach will be presented.

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