Contribution ID: **84** Type: **contributed**

A+M data for validation of tungsten erosion and transport simulations: status and prospects

Thursday, 18 July 2024 10:15 (20 minutes)

Predicting the erosion and deposition of tungsten (W) from plasma-facing components, and the resulting impact of W on the fusion performance, requires an appropriate description of plasma interaction with W ions, atoms, and surfaces. Accurate and validated data on these interactions, and the application of such data to simulations of experiments in existing devices, enables the benchmarking and improvement of crucial predictive capabilities for designing future devices.

Simulations of W erosion and transport in JET, combining the kinetic Monte Carlo code ERO2.0 1 and the JINTRAC integrated suite of codes 2, successfully reproduce the observed W I emission in the divertor [3] as well as the W density in the core plasma [4] in both L-mode and H-mode scenarios with experimentally validated background plasma conditions. However, comparison of predicted and observed line emission from W ions in the edge plasma (approx. W II to W XX) is challenging, partly due to uncertainties in the calculated photon efficiencies of the W emission lines. Conclusively identifying and isolating individual W lines from the measured visible and UV spectra is another challenge.

The atomic data in W transport modelling include W ionisation, recombination, and photon emission rate coefficients from ADAS [5]. In addition, a multitude of atomic and molecular processes and databases are applied within the EIRENE code [6] in the JINTRAC background plasma simulations. Sputtering and reflection yields for plasma-surface interactions in ERO2.0, and the energy and angular distributions of the sputtered and reflected particles, are based on tabulated SDTrimSP [7] data. While current ERO2.0 simulations interpolate pure-material yields to approximate the mixing of deposited and bulk materials, development is currently ongoing to incorporate mixed-material SDTrimSP calculations with varying material concentrations into ERO2.0.

1 J. Romazanov et al 2019, Nucl. Mater. Energy 18 331–8
2 M. Romanelli et al 2014, Plasma Fusion Res. 9 3403023
[3] H.A. Kumpulainen et al 2022, Nucl. Mater. Energy 33 101264
[4] H.A. Kumpulainen et al 2024, Plasma Phys. Control. Fusion 66 055007
[5] “Atomic Data and Analysis Structure”, https://www.adas.ac.uk
[6] D. Reiter et al 2005, Fusion Sci. Technol. 47 172
[7] A. Mutzke et al 2019, “SDTrimSP Version 6.00”, IPP-Report 2019-02

Primary author: KUMPULAINEN, Henri (FZJ)

Co-authors: BREZINSEK, Sebastijan (Forschungszentrum Jülich); ROMAZANOV, Juri (Forschungszentrum Jülich GmbH)

Presenter: KUMPULAINEN, Henri (FZJ)

Session Classification: PSI and PMI modelling