Master Thesis Project:

Study of the incidence of gyrating ions at rough surfaces

Plasma-surface interactions is an important field of research in the attempts to develop nuclear fusion as an economic, environmentally benign and safe energy source for man kind. In preparation for the next international test facility ITER, the most advanced experiments are carried out in the JET tokamak in Europe. One of the critical issues is how wall material migrates between plasma facing surfaces and incorporates fuel at surfaces with net deposition. One of the influencing factors then is the surface roughness. It has been found that material is preferentially deposited in cracks and pits at the surfaces, in particular at the sides of larger pits [1]. Charged particles in magnetized plasmas move primarily along helical orbits and it is a complicated matter how they interact with a rough surface. A research program at JET consists in microanalysis of surfaces using micro ion beam analysis (μ-IBA) methods and microscopy. The proposed project consists in:

- Investigating and comparing different methods for surface topography characterisation, such as stereo scanning electron microscopy (SEM), focus stacking with optical microscopy, focus stacking with SEM, optionally also atomic force microscopy (AFM) and/or confocal microscopy.
- Reviewing and applying existing plasma models that can predict the 3D velocity distribution of ions in the JET plasma boundary approaching a smooth surface [2].
- Applying, optionally improving existing MATLAB code for extracting elemental maps from μ-IBA raw data.
- Applying, optionally improving an existing MATLAB tool [3] to calculate how incident ions are carried from an equipotential plane to a rough surface, for comparing experimental results with modeling.

References


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