# Plasma/Material Interaction Modeling for NSTX-Status & Key Issues

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Motivation

- Plasma/Material Interaction (PMI) is a critical issue for fusion; key concerns are erosion lifetime, core plasma contamination, tritium codeposition

- NSTX is a good test bed for PMI modeling and code/data validation for above issues:
  - high power shots, good diagnostics, multiple materials (Li, C, Mo), wide range of plasma regimes-low & high D-recycle/collisionality, good support modeling (plasma parameters, etc.)
  - aim is to understand present results, and extrapolate to ITER, Fusion Nuclear Science Facility (FNSF), DEMO

Analysis

- Sputtering, evaporation, and transient (ELM's etc) erosion of NSTX divertors (LLD, inner divertor), transport of surface impurities, redeposition, D-trapping, core contamination, and net erosion rate predictions. For Li, C, Mo pure and mixed materials.

- Tools: REDEP/WBC erosion/redeposition code package, HEIGHTS transient effects code package, ITMC-DYN mixed materials code, BPHI-3D sheath code, etc., used with UEDGE, SOLPS, and related plasma SOL code inputs.

Results

- Lithium (solid and static liquid) divertor response-comparison with available NSTX probe, core, etc. data. Power, surface-temperature, and pulse length limit predictions.

- Molybdenum divertor response; with D, Li, C impingement. Multiple plasma regimes (as available-low/high recycling).

- Carbon divertor response-D/C carbon trapping prediction and comparison with post-exposure D trapping data, plasma contamination, erosion rate predictions.

- General elucidation of physics issues; e.g. sheath effects, collisionality and turbulence effects on impurities; comparison with other devices (CMOD, DIII-D)

Next Steps

- Identify needed experiments, diagnostics, models, and computational techniques (e.g., coupled-code supercomputer implementation) to further study NSTX PMI issues and resolve code/data discrepancies.