

Analysis of Coupons and Components Exposed in NSTX

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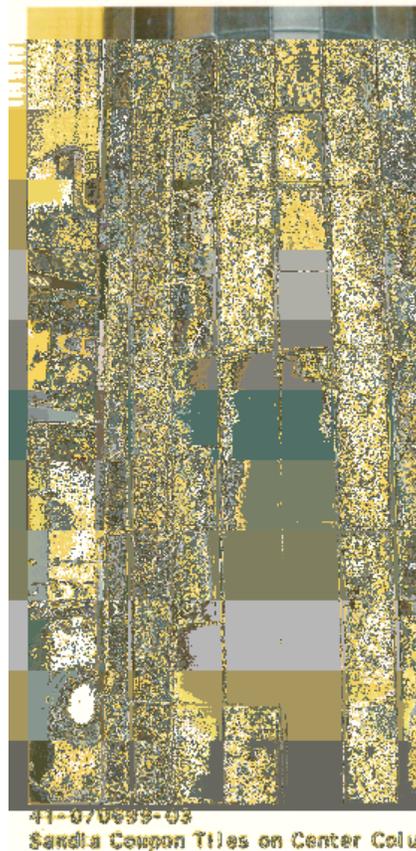
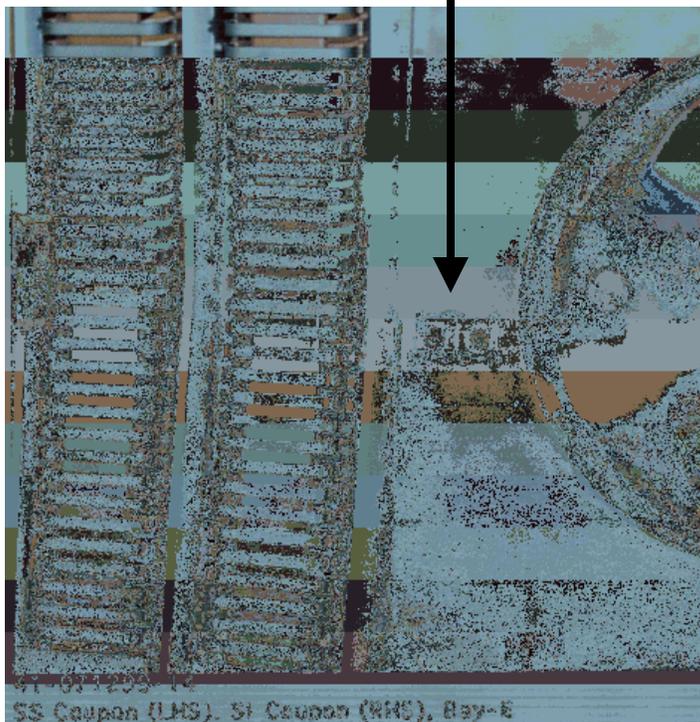
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Plasma conditions depend on the composition of plasma-facing materials (shown by wall conditioning)

The purpose of this experiment is to determine the composition of plasma-facing surfaces and to measure erosion and deposition of materials.

Coupons were exposed in NSTX during the last campaign to determine erosion/deposition at the wall.

Two prepared tiles were exposed to determine erosion/deposition on the center stack.



Coupons, center-stack tiles and other components, will be examined by ion-beam analysis (IBA) to determine the near-surface composition:

- Toroidal midplane array of 4 SS coupons and 2 Si coupons,
- Poloidal array of 12 SS coupons
- 2 Center Stack tiles,
- Graphite tiles from other locations (eg. divertor, stabilizer plates).

Analysis Methods

- Rutherford backscattering spectroscopy (RBS) is used to analyze carbon, oxygen and metals. Sensitive to heavier elements on low Z substrates.
- Nuclear reaction analysis (NRA) is used to analyze deuterium, boron and lithium.
- Proton Induced X-ray Emission (PIXE) is also available to measure metal coverage.
- Large components can be analyzed non-destructively using the Sandia External Ion Beam Analysis (X-IBA) facility.

Measurements probe to depths of several microns, usually give depth profiles.

For more detailed information on ion-beam analysis see:

<http://www.sandia.gov/1100/1111/Elements/tablefr.htm>

Experiments in Progress

SS coupons were initially partially coated with 0.4 μ m carbon film. Change in carbon thickness, (measured by MeV proton backscattering before & after plasma exposure) will give net carbon removal (or deposition) at the wall (see note).

RBS analysis of silicon coupons and carbon films on SS coupons will indicate metal deposition on the wall.

Two center stack tiles were implanted with 300 keV Si. Depth of Si (initially 34 μ m) measured by IBA before & after plasma exposure will indicate net erosion. In case erosion is \gg 1 μ m high, precision measurements of tile geometry will quantify erosion.

Other tiles from the divertor plate and stabilizer plates will be examined by RBS for metal contamination (Cu, Fe, Ni, Cr, Mo, etc.). If metal coverage is high, methods for in-situ metal removal will be tested (eg. sanding, CO₂ pellets).

Post-exposure analysis of the coupons and tiles will begin as soon as they are received at Sandia.

Removal of C from wall coupons by CX neutrals was seen in JET
Rohr, M., Behrisch, R., Andrew, P., and Peacock, A.T, J. Nucl. Mater. **241-243** (1997) 469.