Data for Erosion and Tritium Retention in Beryllium Plasma Facing Materials

Preliminary Status Report

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Erosion

Key data: PISCES experiment.

High flux (relative to beam experiments).

Relevant targets including Be_xW, Be-O, Be-N.

Normal incidence only. Hence very special morphology.

In fusion experiment: Distribution of incident angles (and energies) due to ion temperature, magnetic field incident angle (glancing), ion gyromotion and sheath potential. (We take this distribution for granted.)

Best model based on PISCES data + established older data: Take PISCES for normal incidence, use beam data for angular dependence, multiply by 2 to compensate for morphology, presto.

How to do better?

Need MD (or MD + KMC) calculations without adjustable parameters, show that it fits PISCES data including evolution of morphology, then use the MD (or MD + KMC) for actual spectrum of incident particles.

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Erosion, …

MD + KMC for PISCES erosion data.

MD part is obvious. How important is the treatment of hydrogen diffusion (or other slow process) for this erosion calculation? Can one simulate PISCES erosion data using MD alone?

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Hydrogen (Tritium) Retention

Hydrogen (H, D) profile and migration is studied in Garching, Jülich, UCSD.

NRA, XPS for profile measurements; TDS for trapping energies.

Do we have, finally, a calibrated model for hydrogen (H, D, T) migration?

Key question for thick Be tiles: how much (H, D, T) will diffuse or stick into the bulk, never come out.

(a) Case of clean target tile, no erosion or redeposition; need to understand migration as a function of target temperature. (Operating temperature and bake-out.)

(b) Case of redeposited layer. Again we need a calibrated model for hydrogen migration, but now in the different (amorphous? BeD_x?) kind of beryllium.

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Support for diagnostics

Beyond basic data for erosion and tritium retention we want to support experiment.

Spectroscopic data for erosion measurements: (Making sense of S/XB.)

Need to know how Be is eroded: Be^0, Be^+, BeD, BeD_2, maybe even BeD_3 or some molecular ion. Need (ro-)vibrational state, need molecular process cross sections, atomic excitation and ionization, also molecular ionization and spectroscopy of BeD, BeD^+.

Detailed data for simulation of TDS: …

Other: …

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