The DIONISOS Helicon Linear Plasma Device: Modifications and Research Activities on Low-Z PFC

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DIONISOS (Dynamics of ION Implantation and Sputtering Of Surfaces) is a steady-state linear plasma device located at the Plasma Science and Fusion Center at MIT. It is capable of either ion beam analysis (IBA) or controlled ion irradiation damage during plasma exposure, in order to study plasma-wall interactions for nuclear fusion relevant applications. The ion beam (light or heavy species) is generated via a 1.7 MV Tandem ion accelerator. Electron temperatures up to 15 eV, deuterium (D) fluxes up to 10^{22} m^{-2} s^{-1}, and exposure temperatures up to 1200C can be reached.

DIONISOS is connected to a liquid Lithium wetting chamber, enabling in-vacuo wetting of materials followed by plasma exposures. A custom-designed, magnetically coupled rotary bellows manipulator allows for vacuum transfer of the sample holder between the two chambers.

Current research focuses on studying the dynamics of retained D in low-Z materials such as boron or liquid lithium on tungsten substrate during plasma exposure. These studies enable time-resolved measurements of D behavior within the materials in real-time and help investigate the coupled effects of radiation damage and plasma exposures on the substrates.

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