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P3.052 UWAVS first mirror after long plasma cleaning: surface properties and material re-deposition issues

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One of the important aspects of the plasma cleaning of the front-end mirrors (FM) in ITER UWAVS diagnostics is to understand surface roughness after multiple cleaning runs and to minimize possible contamination due to unwanted sputtering of the mirror surface and neighboring walls. The capacitive coupled RF 30-60 MHz is a candidate for the UWAVS FM cleaning. It generates ion fluxes of tens of electron-volts sputtering contaminants as well as construction materials. In the present report, we discuss materials analysis with electron diffraction spectroscopy and x-ray photo-electron spectroscopy for Al, Mo and W samples after cleaning with 30-60 MHz discharges in He for various locations inside the vacuum compartment. Typical ion energies were 50-70 eV at the RF electrode and 20-30 eV at the grounded wall. Mirror reflectivity was measured after removing W, Al, Al₂O₃ contaminants in 60-hour exposure and showed satisfactory results. Materials and their oxides sputtered from the FM were deposited at distances 2-4 cm from the electrode with rates 0.1-0.05 nm/hr. At the Second Mirror, the deposition rates were estimated 0.01 nm/hr. or lower. The experiments showed advantages of Mo a construction material due to lower sputtering. Dielectric material traces were found due to electrical damage of cable feedthrough at higher powers. Measures to prevent the sputtering of dielectrics are discussed. The Mo-mirror was etched at 0.5-1 nm/s rate. That did not change the mirror reflectivity after 100 hours of exposure, but the overall effect on the reflectivity considering full service time is yet to be investigated.

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