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A 60 kV Plasma Immersed ION Implantation and Deposition Facility Development and Performance Test

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A 60-kV plasma immersion ion implantation and deposition (PI³D) system has been developed for surface modification of materials. A processing chamber having 100 L volume is a vertical cylinder type and equipped with three rectangular magnetron sputter sources. Plasma source is an 2 kW, 12.56 MHz ICP with multi-cusp magnetic confinement. Uniform plasma with density of $10^{10} - 10^{12} \text{ cm}^{-3}$ at pressure of 0.2 - 2.0 mTorr is produced by an internal and insulated antenna for an ICP. Specimen can be heated or cooled in the range of 40 - 400 °C by halogen heater and stage-cooling. A 60 kV, 200 A, 10 kW pulsed power supply comprises 10 kV IGBT stacks and 1:6 step-up high-voltage pulse transformer. A 6 - 60 kV negative pulse with rise time of 0.7 s, pulse width of 2 - 6 s, and repetition rate up to 2 kHz is applied to the stage in PI³D mode. Plasma parameters were investigated using mass analyzer and RF-compensated Langmuir probe. Performance of the system and characteristics will be presented and discussed.