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Importance of Dielectric Elements for Attaining Process Uniformity in Capacitively Coupled Plasma Deposition Reactors

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Figure S1 compares the ionization rate profiles of the two different wafers. Figure S1a,b show the time-averaged direct ionization rate profiles for Cases 2 and 3. As similarly depicted in Figure 2a, the radial distributions of the ionization rate are uniform at $r < 130$ mm, and as a common feature, the highest values are detected near the bottom electrode edge as a result of the electrostatic effects. Similarly, Figure S1c,d present the time averaged step ionization rate profiles for Cases 2 and 3. As similarly observed in the contours in Figure S1a,b, their highest values are also detected near the bottom electrode edge.

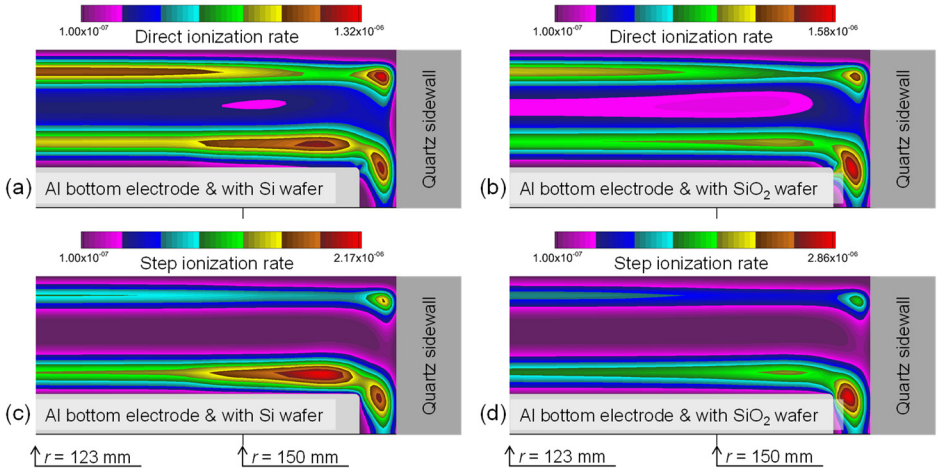

Figure S1. Effects of the dielectric constant of the wafer on the spatial distribution of the plasma parameters. Contour plots for the spatial profiles of the time-averaged SiH_2^+ production rate (kmol·m^{-3}·s^{-1}) for (**a**) Case 2 and (**b**) Case 3 for $r \geq 123$ mm. Contour plots for the spatial profiles of the time-averaged Si^+ production rate (kmol·m^{-3}·s^{-1}) (**c**) for Case 2 and (**d**) for Case 3 for $r \geq 123$ mm. The profiles are radially uniform for $r < 123$ mm.

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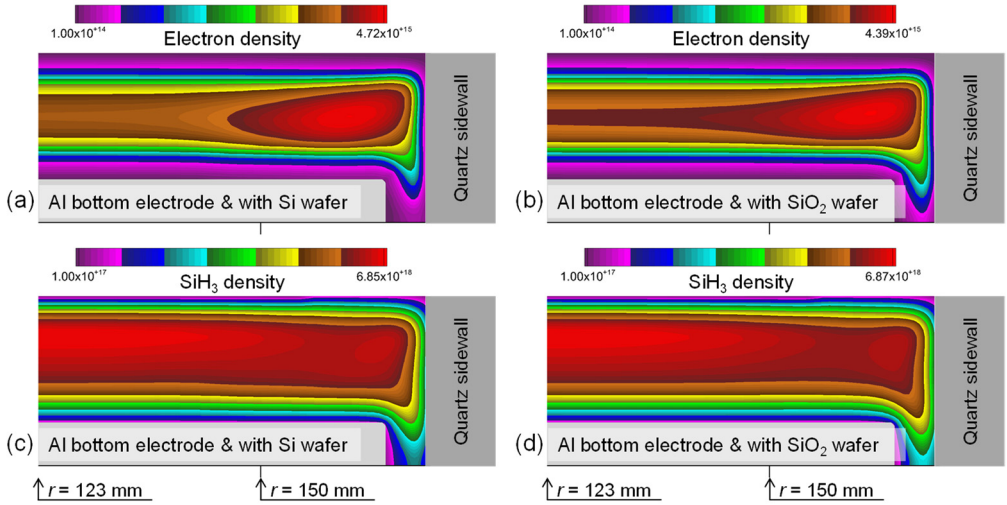

Figure S2. Effects of the dielectric constant of the wafer on the spatial distribution of the plasma parameters. Contour plots for the spatial profiles of the time-averaged electron density (m^{-3}) for (**a**) Case 2 and (**b**) Case 3 for $r \geq 123$ mm. Contour plots for the spatial profiles of the time-averaged SiH_3 density (m^{-3}) (**c**) for Case 2 and (**d**) for Case 3 for $r \geq 123$ mm. The profiles are radially uniform for $r < 123$ mm.

Figure S2a,b show the time-averaged electron density profiles for Cases 2 and 3. As similarly depicted in Figure S1, the radial distributions of the electron density are also uniform at $r < 130$ mm, and as a common feature, the off-axis maxima of the electron density (N_{e0}) are detected near the electrode edge as a result of the excitation and ionization rate distributions. Similarly, Figure S2c,d present the time-averaged SiH_3 density profiles for Cases 2 and 3. As observed in the series of contours in Figure S2, because different wafers are used, the electron and SiH_3 densities are noticeably different for Cases 2 and 3. These effects flattened the peak of the electron density profile by reducing the accumulation of charged species in the edge region. Therefore, the ion density and flux profiles in the radial direction become more uniform. Recall that the distribution of the ionization rates in Case 3 is more vertically symmetric than that in Cases 1 and 2 by being more focused near both the top and bottom sidewalls.