Rapid Low-Temperature Atomic Layer Deposition of HfO_2

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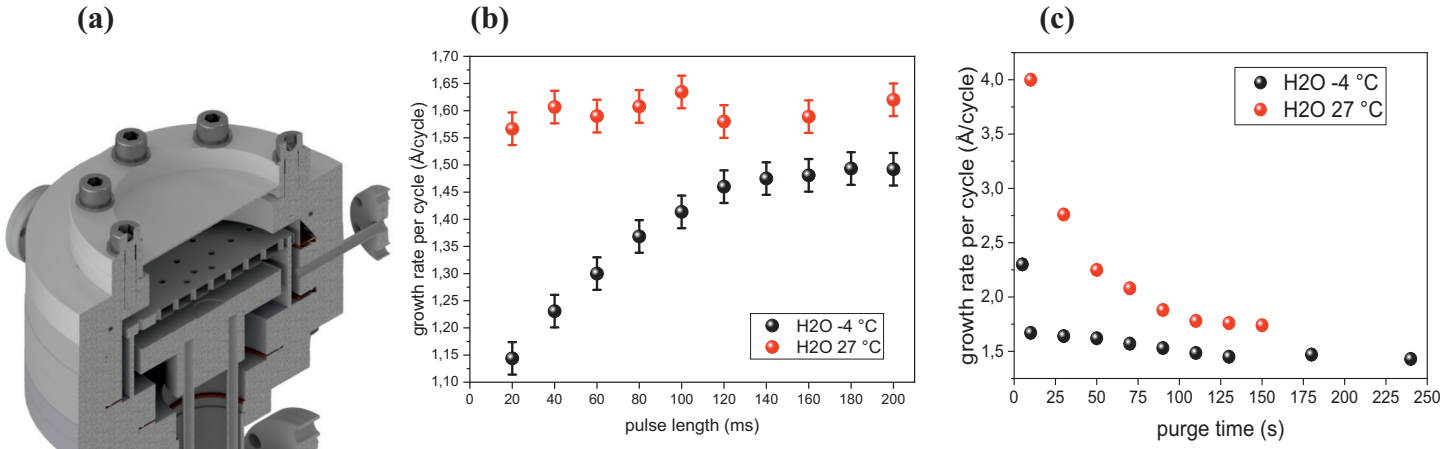
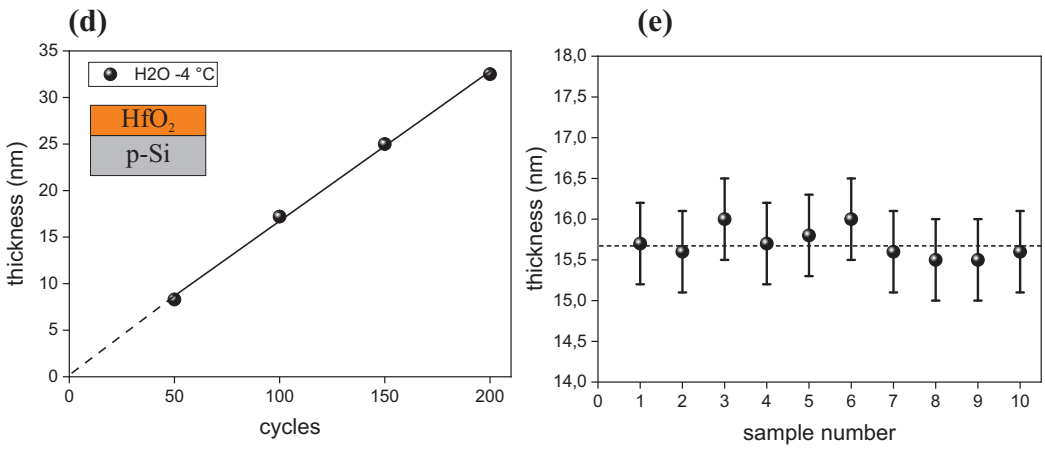
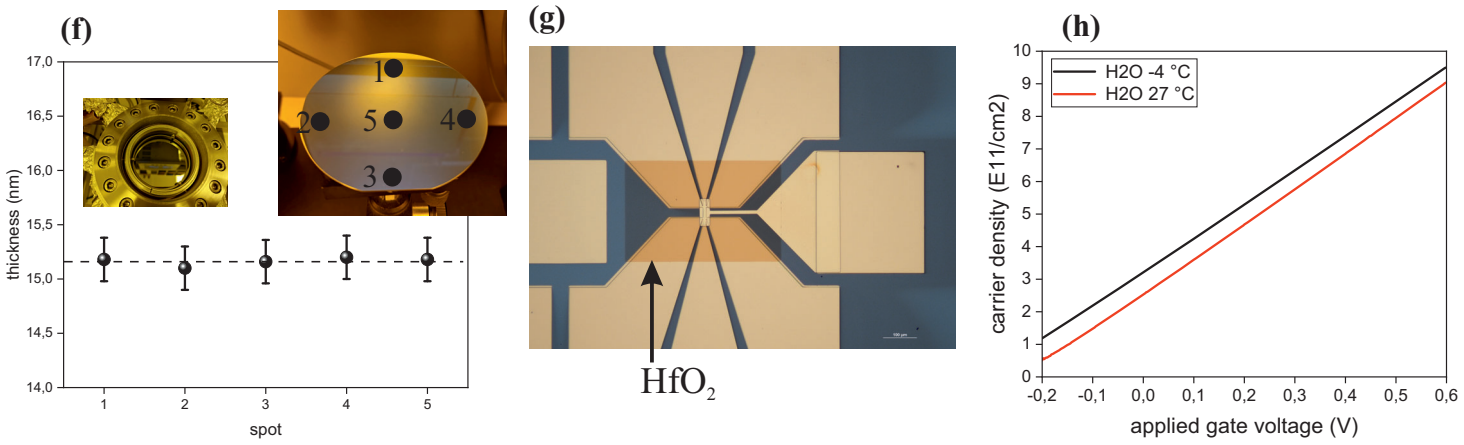


Cross-section of our home-made ALD reactor (a). Hafnium oxide growth rate per cycle as a function of pulse length at 30 °C sample stage temperature for both cooled (-4 °C) and non-cooled (27 °C) water source (b). Growth rate of hafnium oxide as a function of purge time at a fixed sample stage temperature of 30 °C for 27 °C and -4 °C water source temperatures (c).



The hafnium oxide film thickness on thermally oxidized silicon varies linearly with the number of cycles (d), and the deposition rate is reproducible (e).



The deposition is homogeneous across the surface of the sample stage (f). Hafnium oxide gate dielectric patterned by lift-off on a high electron mobility quantum well device (g). The gate action of the device involving the rapid low-temperature atomic layer deposition of hafnium oxide (black) is identical to the previous technology (red), but can is deposited in 1 hour instead of 10 hours.