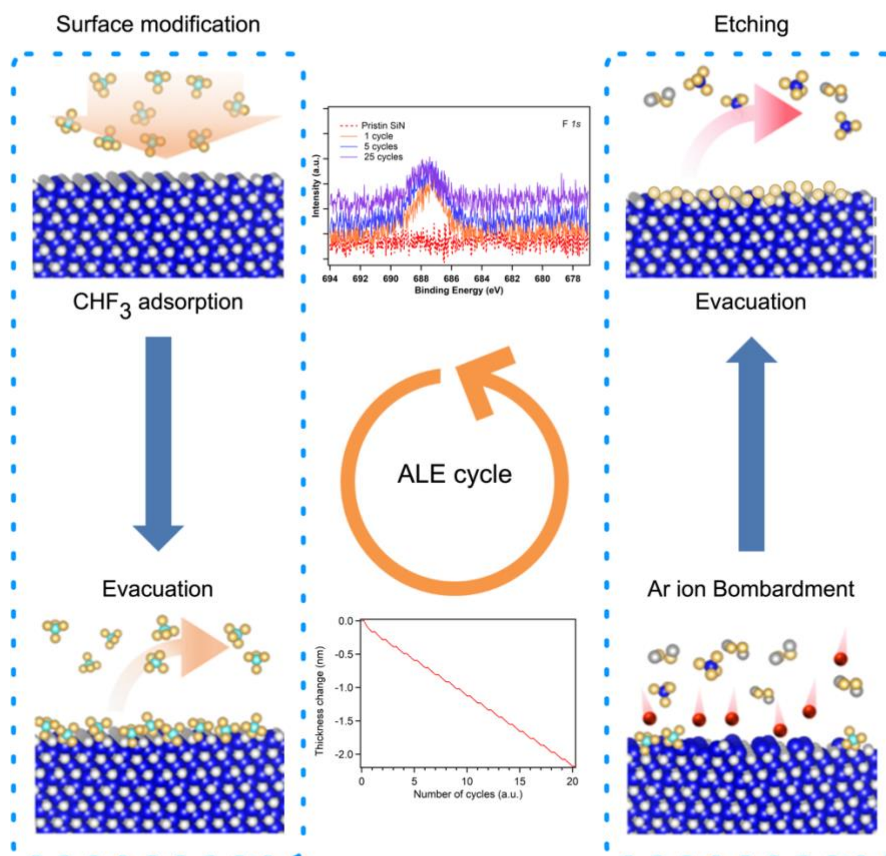

Figure 1. A schematic for fluorocarbon-based plasma-assisted ALE. One ALE cycle combines a direct CHF_3 adsorption step and an argon ion bombardment etch step. The F 1*s* XPS spectra show the evolution of the 1st, 5th and 25th ALE cycle performed at 100 °C. An obvious F 1*s* peak is detected after the first Ar bombardment step indicating the energetic argon ions facilitate reaction between fluorine and silicon. The ellipsometry result show a constant etch rate for the 20 ALE cycles.

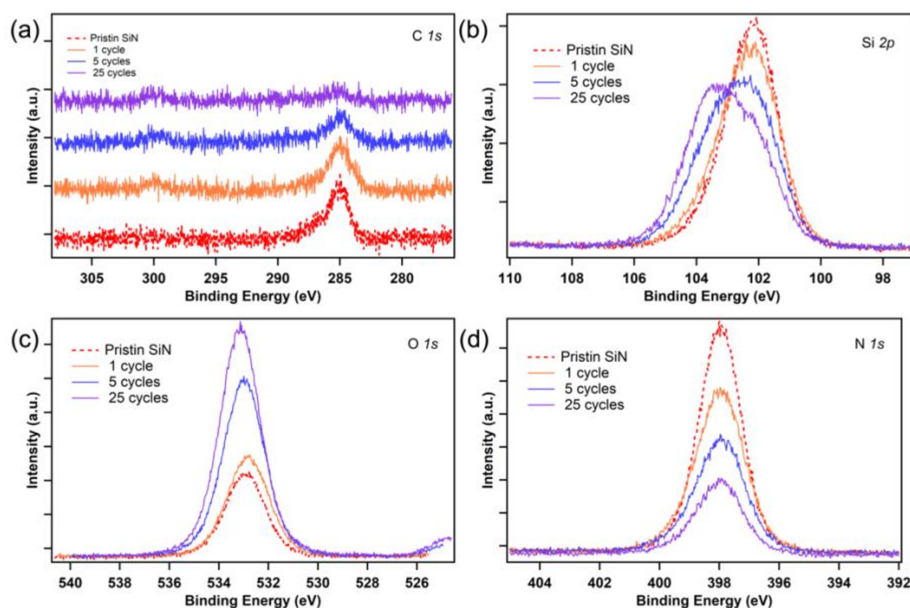

Figure 2. (a) C 1*s*, (b) Si 2*p*, (c) O 1*s* and (d) N 1*s* XPS spectra for silicon nitride after 1, 5 and 25 ALE cycles with CHF_3 adsorption at 100 °C and Ar ion bombardment with 200 V DC bias voltage.