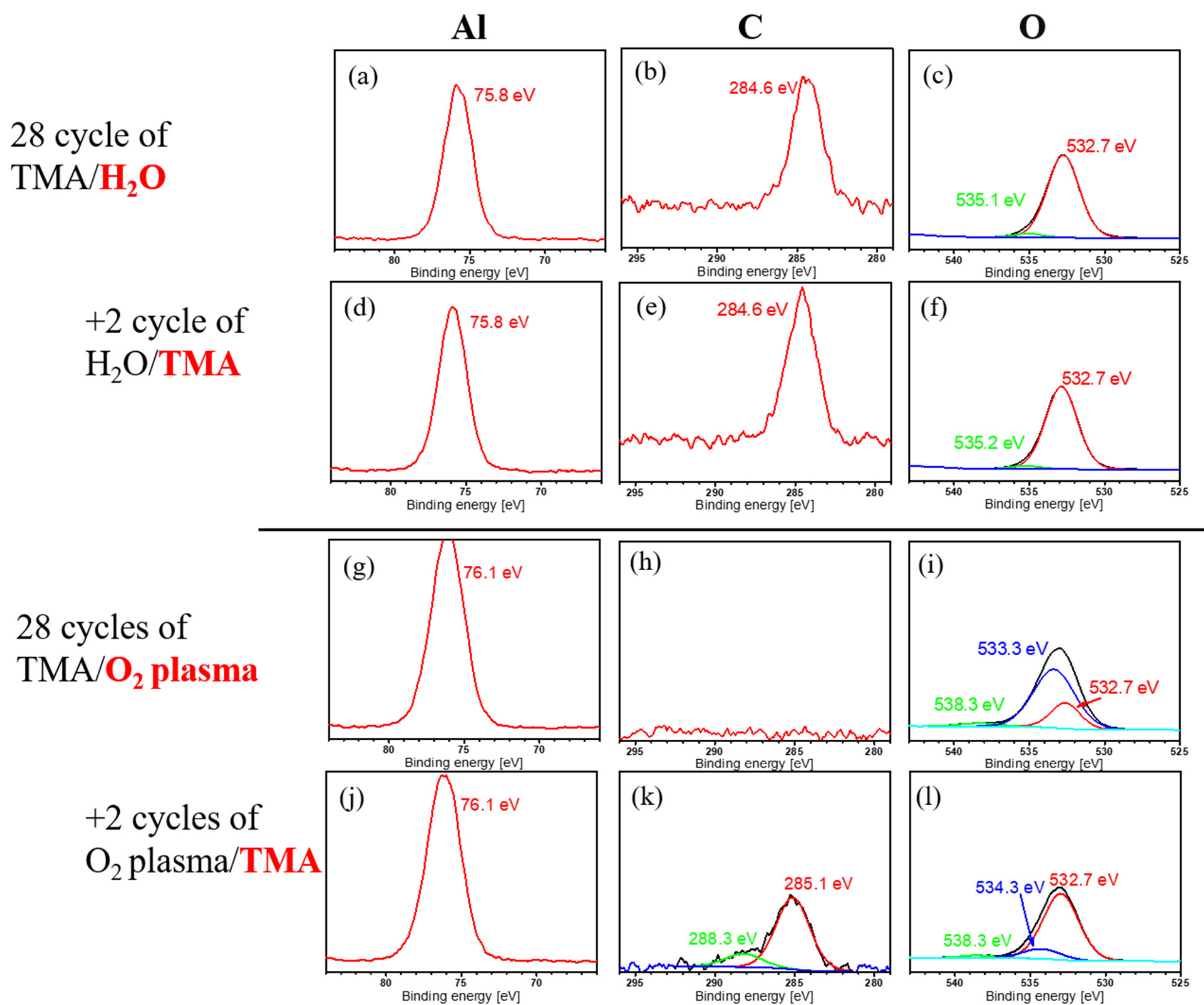

Figure S1 *in vacuo* XPS spectra of the TMA thermal process with water taken after the (a-c) H_2O and (d-f) TMA exposure, and the plasma process taken after the (g-i) O_2 plasma and (j-l) TMA exposure for Al, C and O elements, respectively. The deposition temperature is 60°C.

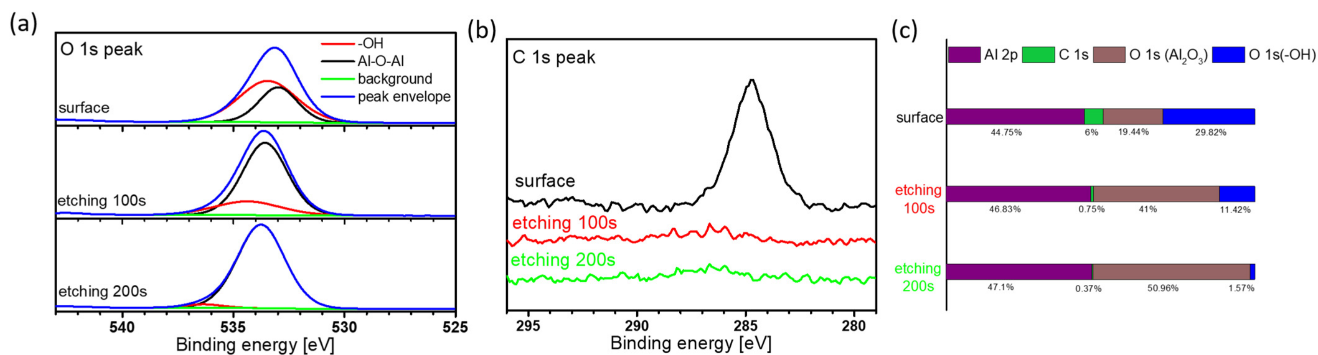

Figure S2 *in vacuo* XPS depth profile for sample deposited by 200 cycles of the TMA/water process at 60°C: (a) O 1s spectra, (b) C 1s spectra and (c) the element concentration. Samples were treated by a 500 eV Ar ion beam for 0s, 100s and 200s, respectively.

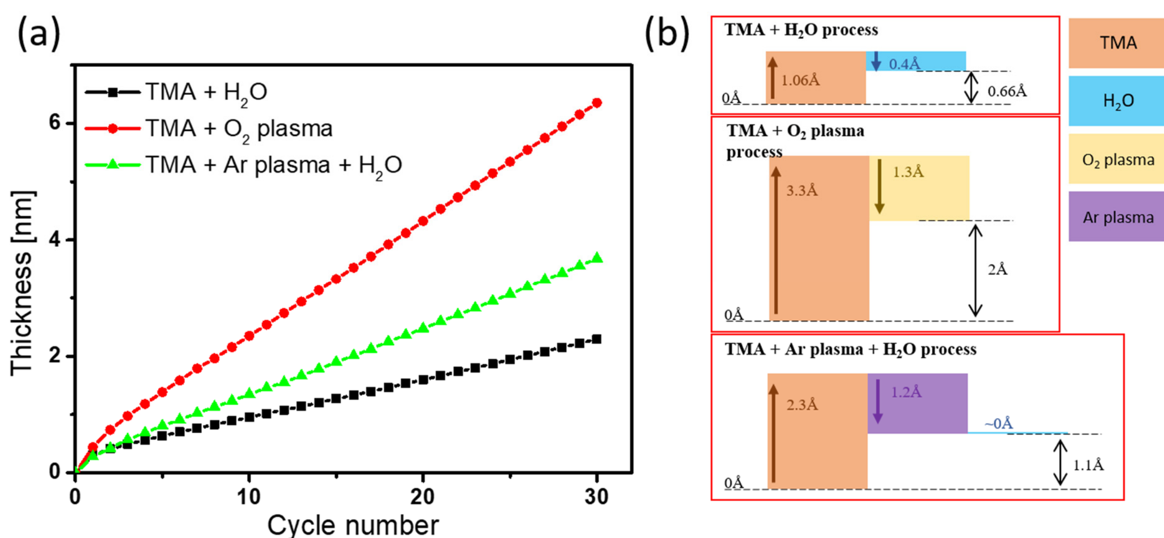

Figure S3 (a) The linear growth behavior of three different TMA processes at 60°C and (b) the thickness change after every pulse exposure for TMA/H_2O, TMA/O_2 plasma and TMA/Ar plasma/H_2O processes measured by *in situ* SE.