SiO$_2$ thin film growth through a pure Atomic Layer Deposition at Room-Temperature

Supporting information

S1:

![Graph showing the evolution of SiO$_2$ film thickness as a function of ALD cycles]

Evolution of SiO$_2$ film thickness as a function of ALD cycles based on the literature. All processes display a linear evolution with the number of cycles at room temperature [41,42,66] as well as high temperatures (600 K) [67].
Growth kinetics of SiO₂ for sequential exposure of the surface to 90s of SiCl₄ and 90s of H₂O, indicating a growth rate of 0.6 μg.cm⁻² per cycle. Panel (a) shows a typical zoom on 10 cycles of the total 2000 cycles deposited film. Panel (b) corresponds to the view of 2 cycles deposition. Lower panels represent the programmed exposures of H₂O (c), SiCl₄ (d) and NH₃ (e).
ALD room temperature growth of SiO₂ under NH₃ catalytic regime. Through the injection of NH₃, the O-H bond becomes weaker, -Si can easily react with –O at the surface to form –O-Si-(Cl), or –O-Si(Cl₂)-O- ligands at the surface. -O coming from water injection directly react with –Si to finally form a SiO₂ monolayer.
In-situ RGA mass spectrometric monitoring of successive 90s H₂O pulses alternated with 300s N₂ purge. The panel corresponds to the measured intensity of H₂O (m/z = 18 uma).
Fig. 5: Growth kinetics of pure ALD SiO$_2$ film with sequential exposure of the surface to 90s of SiCl$_4$, 90s of NH$_3$ and 90s of H$_2$O. (a) A typical zoom of the in situ monitoring of 500 loops deposition showing a growth rate of 0.02 µg.cm$^{-2}$ per cycle. The panel (b) represents a zoom of the 60% advanced deposition. Lower panels represent the programmed exposures of SiCl$_4$ (c) NH$_3$ (d) and H$_2$O (e).
Growth kinetics of porous SiO$_2$ grown with sequential exposure of the surface to 100 ms of SiCl$_4$, 2s of NH$_3$ and 2s of H$_2$O. The in situ monitoring of 300 loops deposition corresponds to a growth rate of 1.5 $\mu$g.cm$^{-2}$ per cycle. The insert represents a zoom of 10 cycles process.