<u>Supplementary information:</u> Mechanisms limiting conformality in thermal and plasma-assisted ALD investigated by Lateral High Aspect Ratio structures

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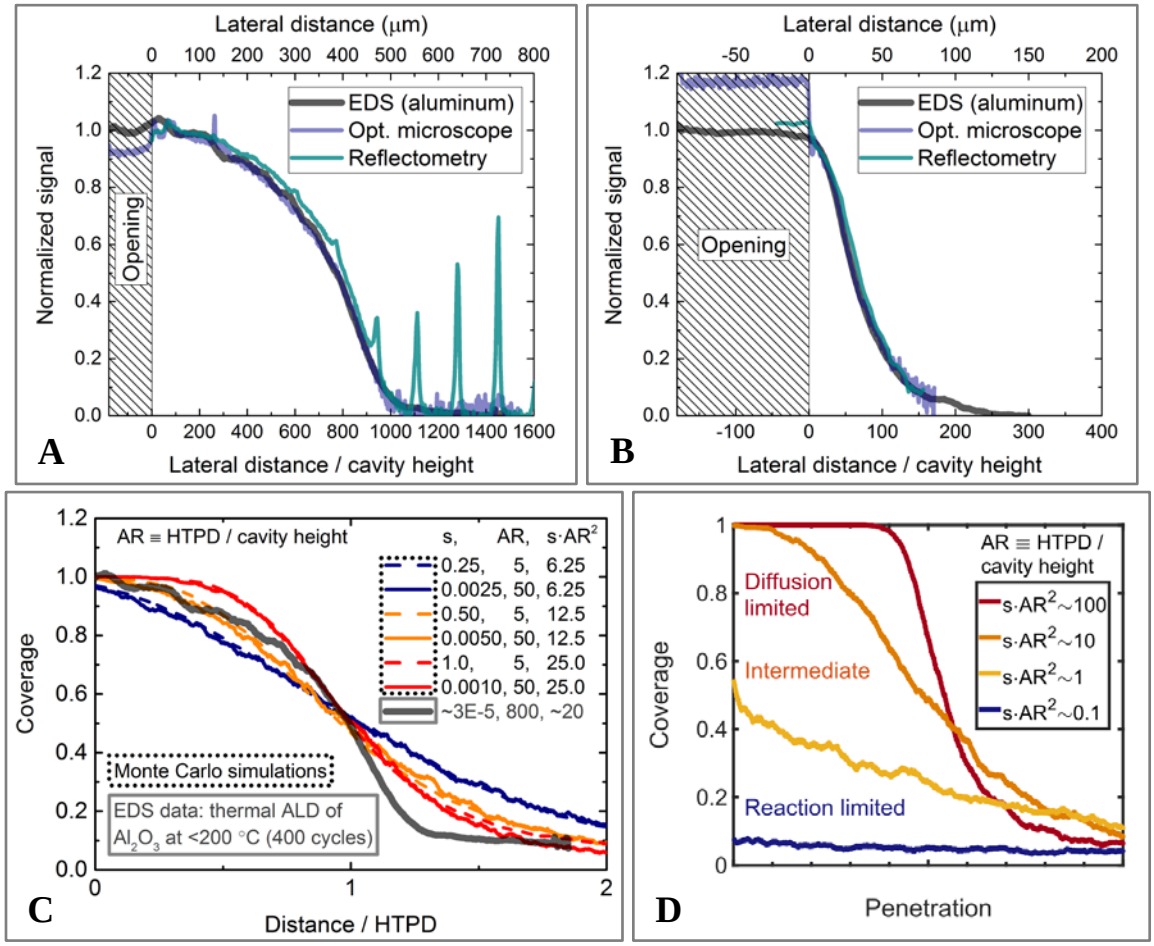

Figure S1: Normalized thickness profiles of Al_2O_3 deposited in Lateral High Aspect Ratio analysis structures supplied by VTT (LHAR3), using **(A)** 400 cycles thermal ALD and **(B)** 300 cycles plasma ALD at 200 ℃ substrate table temperature. The diagnostics compared in this work (EDS, optical microscopy, reflectometry and focused SE) generally show good correspondence. In **(C)** the thickness profile of **(A)** is compared to Monte Carlo simulations, where the sticking probability s and aspect ratio AR at half-thickness-penetration-depth (HTPD) is varied. The shape of the profile seems to depend on the value of $s \cdot AR^2$. As illustrated in **(D)**, diffusion-limited growth occurs for high $s \cdot AR^2$, while reaction-limited growth occurs when $s \cdot AR^2$ is low. For $s \cdot AR^2 \sim 10$ an intermediate growth regime is seen, yielding a sloping profile. This is consistent with the sloping profile observed in **(A)**, where $AR = 800$ is reached at a low sticking probability $s \sim 3 \cdot 10^{-5}$ of H_2O with $–CH_3$ at $T < 200$ ℃.[1] For the plasma-assisted ALD case shown in **(B)**, the penetration depth is limited by recombination of O radicals. These cases exemplify how LHAR structures can be employed to study ALD chemistry for conformal deposition.

1. V. Vandalon and W.M.M. Kessels, Appl. Phys. Lett. **108**, 011607 (2016)