Supplementary information:

Radical Surface Recombination Probabilities during Plasma ALD of SiO_2, TiO_2 and Al_2O_3 Determined from Film Conformality

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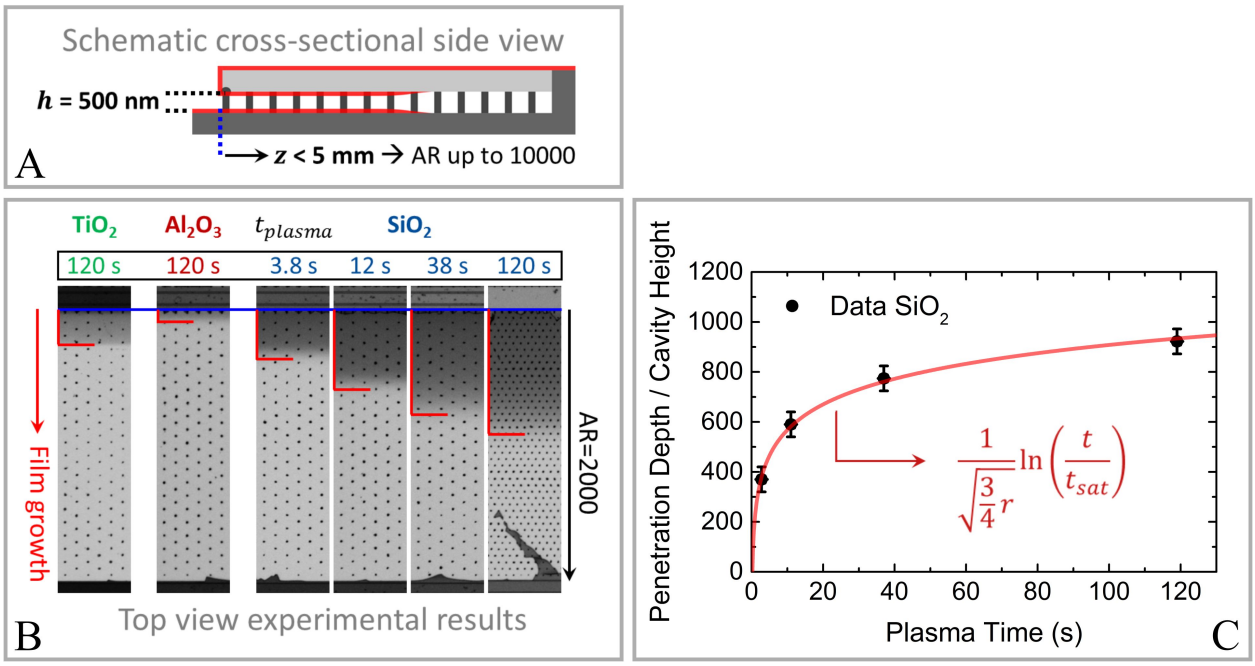

Figure S1: Panel **(A)** shows a schematic side view of a PillarHall® LHAR4 structure developed at VTT. In these extremely high aspect ratio (AR) structures film growth is limited up to a certain penetration depth for even the most conformal processes. In the case of plasma ALD, film penetration is typically limited by loss of the reactive plasma radicals through surface recombination. The amount of surface recombination, and the corresponding penetration depth, can strongly depend on the grown material as experimentally observed in panel **(B)**. For the same plasma exposures (120 s O_2/Ar plasma), film growth reaches AR>250, AR~80 and AR~900 during plasma ALD of TiO_2, Al_2O_3 and SiO_2, respectively. Moreover, it is observed that the penetration depth increases logarithmically with the plasma time. This is a direct consequence of the exponentially decaying radical density corresponding to the radical recombination probability r on the grown material surface. In panel **(C)** it is demonstrated that this relation is well described by a simple expression which can be used to straightforwardly determine r. For plasma ALD of SiO_2 this gives $r=(6\pm3)\cdot10^{-5}$, which compares well to reported literature values.