Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting Information

Visualization of label-free Titanium Dioxide Nanoparticles Deposition on Surfaces with Nanoscale Roughness

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Submitted to

Environmental Science: Nano

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SCTF Preparation

Silicon chips (Kurt J. Lesker Co.) were located on an electron-beam evaporator and were evaporated at 2×10^{-6} mbar. The incident flux of particles at the sample surface was at an angle of 85° with respect to the sample surface normal. The highly ordered three-dimensional columnar growth of the Si-SCTF commenced under an angle of approximately 60° with respect to the sample surface normal, where the evolving columns joined a common slanting direction. The deposition rate was kept at 5 Å/s, and the rate was monitored using a quartz crystal microbalance with dissipation (QCM-D). A total of 500 nm of equivalent QCM thickness was achieved after 40 minutes of deposition time. When developing SCTFs for the microfluidic channel, to have both anisotropic SCTF and isotropic glass surfaces on the substrate, a narrow tape was attached to cover part of the glass substrate prior to the GLAD deposition. The tape was then removed after deposition, leaving the area under the tape free from SCTF.

The prepared samples with Si-SCTF were then covered by a 4-nm-thick conformal alumina (Al_2O_3) using atomic layer deposition (ALD) (Fiji 200, Cambridge Nanotech). Two precursors of trimethylaluminum (TMA) and 18.2 MΩ-cm Nanopure water were each pulsed for 60 ms inside a vacuum chamber at 150°C and repeated for 45 cycles.

The `N'-shape pattern on glass substrate was prepared as follows. First, a circular 25.4 mm diameter and 1.5-mm-thick glass substrate was covered by spin coating Shipley S1813 photoresist (MicroChem Co., Westborough, MA) at 3000 rpm for 45 seconds to achieve a film with a thickness of approximately 1.5 µm. The sample was then baked at 115°C for 90 seconds and exposed to 350 watt UV light under a mask with a regular pattern of approximately 1×1 mm^2 size `N' shapes for 8 seconds. The exposed sample was developed with an MF-319 developer (MicroChem Co., Westborough, MA) for 50 seconds, rinsed with water, and dried with nitrogen. Si-SCTFs were then grown everywhere on the sample (glass as well as the photoresist area) (Figure S1a-1). In a next step, Si-SCTFs deposited on top of the photoresist were removed using acetone. Only SCTFs on the `N'-shape glass surfaces remained. The remaining Si-SCTF areas were then covered by a 4-nm-thick conformal alumina (Figure S1a-2).

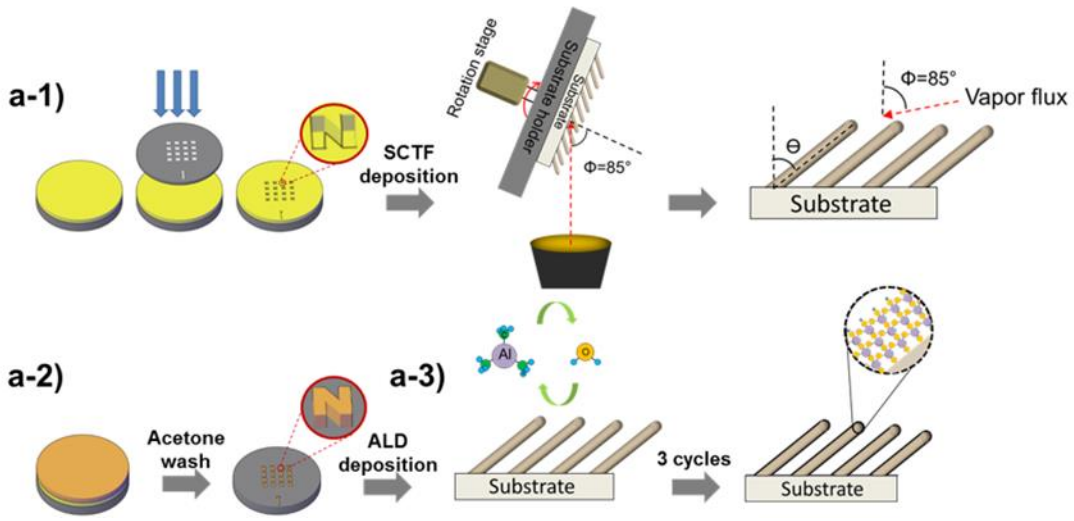

Fig. S1 a-1) Schematic of 500 nm thick Al_2O_3-Si-SCTF `N'-shape pattern on glass substrate preparation using photolithography and subsequent glancing angle deposition, and a-2) chemical mask removal and subsequent atomic layer deposition.