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Supporting Information

A Facile Route to Patterned Epitaxial ZnO Nanostructures by Soft Lithography

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Additional SEM Images

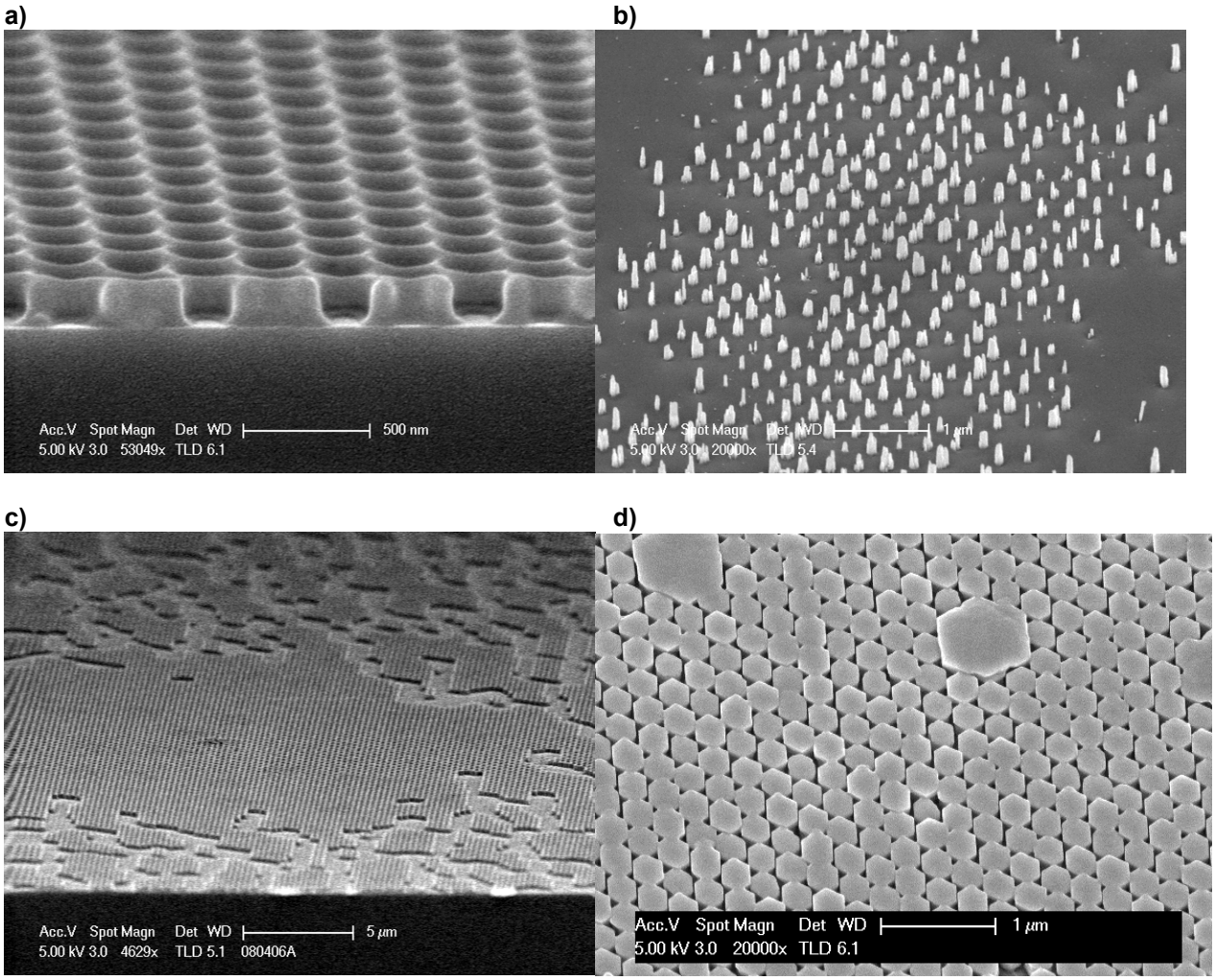

Figure S1. SEM images of a) the patterned thermoplastic resist NXR-1020, b) the sample patterned with NXR-1020 after attempting a patterned ZnO growth, showing limited growth through pinholes, c) the patterned photoresist NXR-2010, showing the poor adhesion to the surface of the ZnO, and d) Partially coalesced ZnO nanorods.

Additional Experimental Details

*General:*Unless otherwise noted, chemicals were purchased from Aldrich and used as received.Tridecafluoro-1,1,2,2-tetrahydrooctyl)trichlorosilane (TDFOCS, SIT8174.0) and poly[(mercapto-propyl)methylsiloxane] (PMMS, SMS992) were purchased from Gelest. Triethylene glycol divinyl ether was purchased from PolySciences, Inc. Ethoxylated (4) bisphenol A dimethacrylate (BPADMA) was kindly donated by Sartomer.

Epitaxial ZnO Film Substrate Preparation: First, a (111) $MgAl_2O_4$ single-crystal substrate (MTI) was inserted into 24 ml of an aqueous solution of 26 mM zinc nitrate and 300 mM ammonium nitrate which had been preheated to 90°C in a sealed PFA vessel. Insertion of the substrate was immediately followed by 0.7 ml of 1.5 M aqueous ammonia to initiate the formation of ZnO. The vessel was then resealed and returned to 90°C for at least several hours before removing the substrate. Once removed, the ZnO seeded substrate was thoroughly rinsed with H_2O and blown dry before being annealed in air to 500°C for 2 hours. The second growth step was performed by inserting the annealed substrates into a room temperature aqueous solution of 26 mM zinc nitrate, 7 mM sodium citrate, and 350 mM aqueous ammonia contained in a sealed PFA vessel. The sealed vessel was then heated in a 90°C oven for at least 12 hours.

Templated ZnO Nanostructure Growth: The growth solution was prepared by mixing excess ZnO powder into a 0.5 mol L^{-1} aqueous ammonia solution. The mixture was magnetically stirred in a sealed container for several days to allow complete saturation with dissolved ZnO. During this time, the pH of the solution was periodically checked and readjusted to pH 12 with small amounts of NaOH or HNO_3. The reactor growth chamber was filled with solution by pumping the mixture through a 0.2 μm filter removing all undissolved ZnO powder. The growth chamber solution was heated to 90 °C over 2 hours and held for an additional hour prior to inserting the nanoimprint patterned substrate. The substrates were kept in the growth solution for 10 to 60 min, depending on the nanostructure being grown, during which time the solution flow between the growth and dissolution chambers was set to 1 ml/min.

Sample Characterization: Scanning electron microscope imaging was performed on a FEI XL30 Sirion with a field emission gun source.