Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

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Anomalous adhesive superhydrophobicity on the lotus leaf grown with aligned ZnO nanowire arrays

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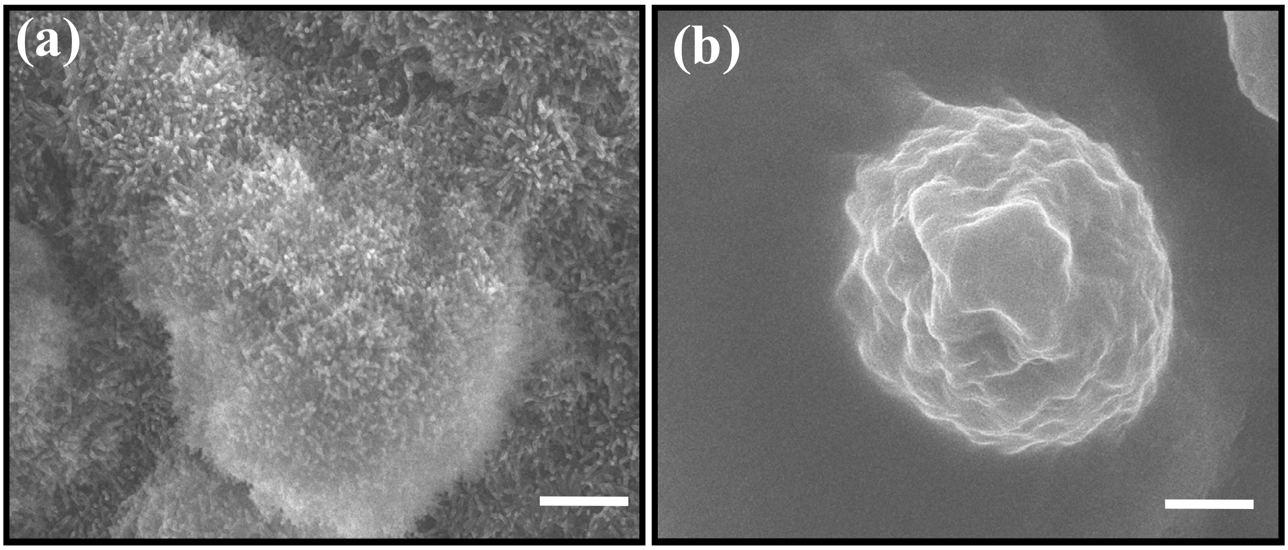
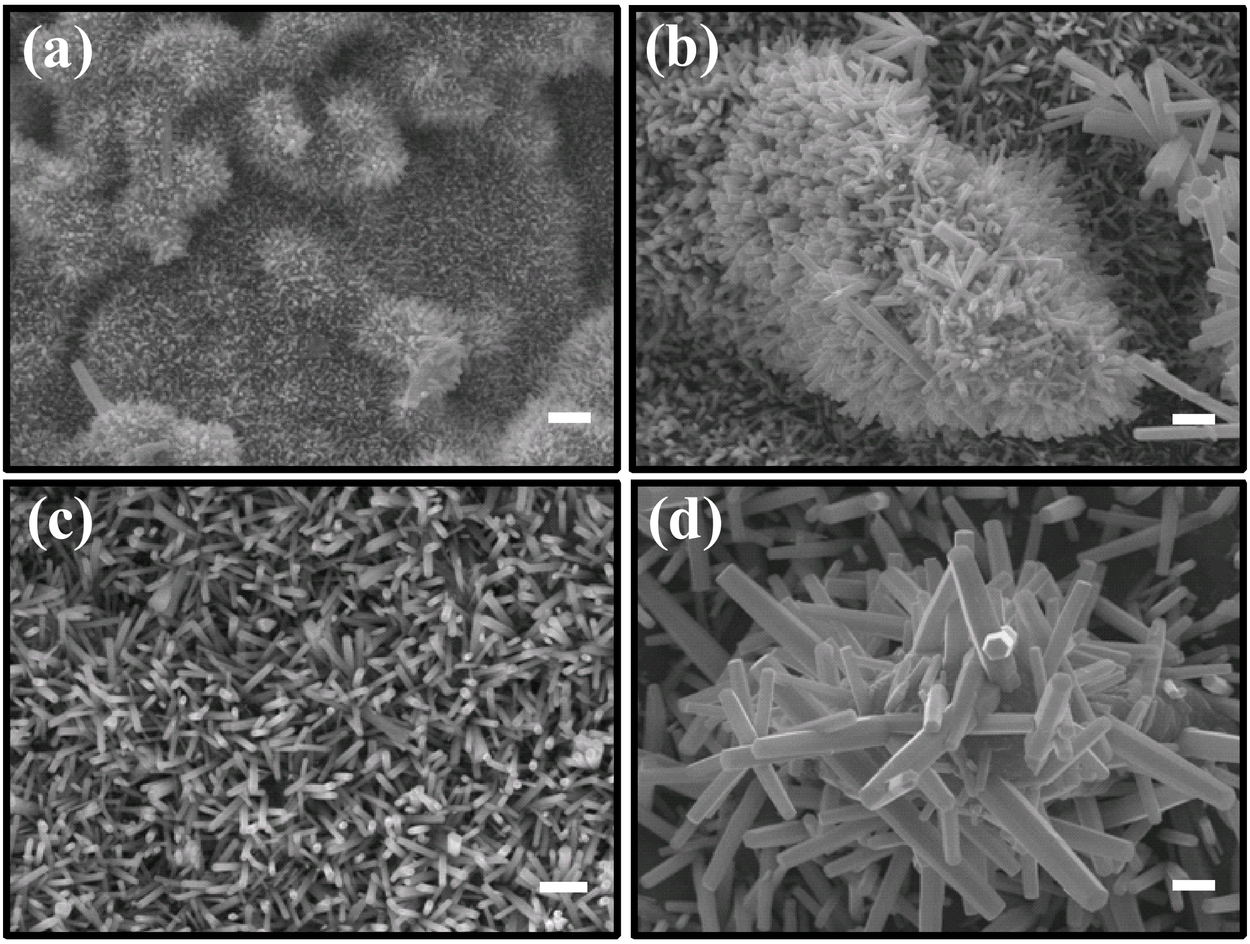
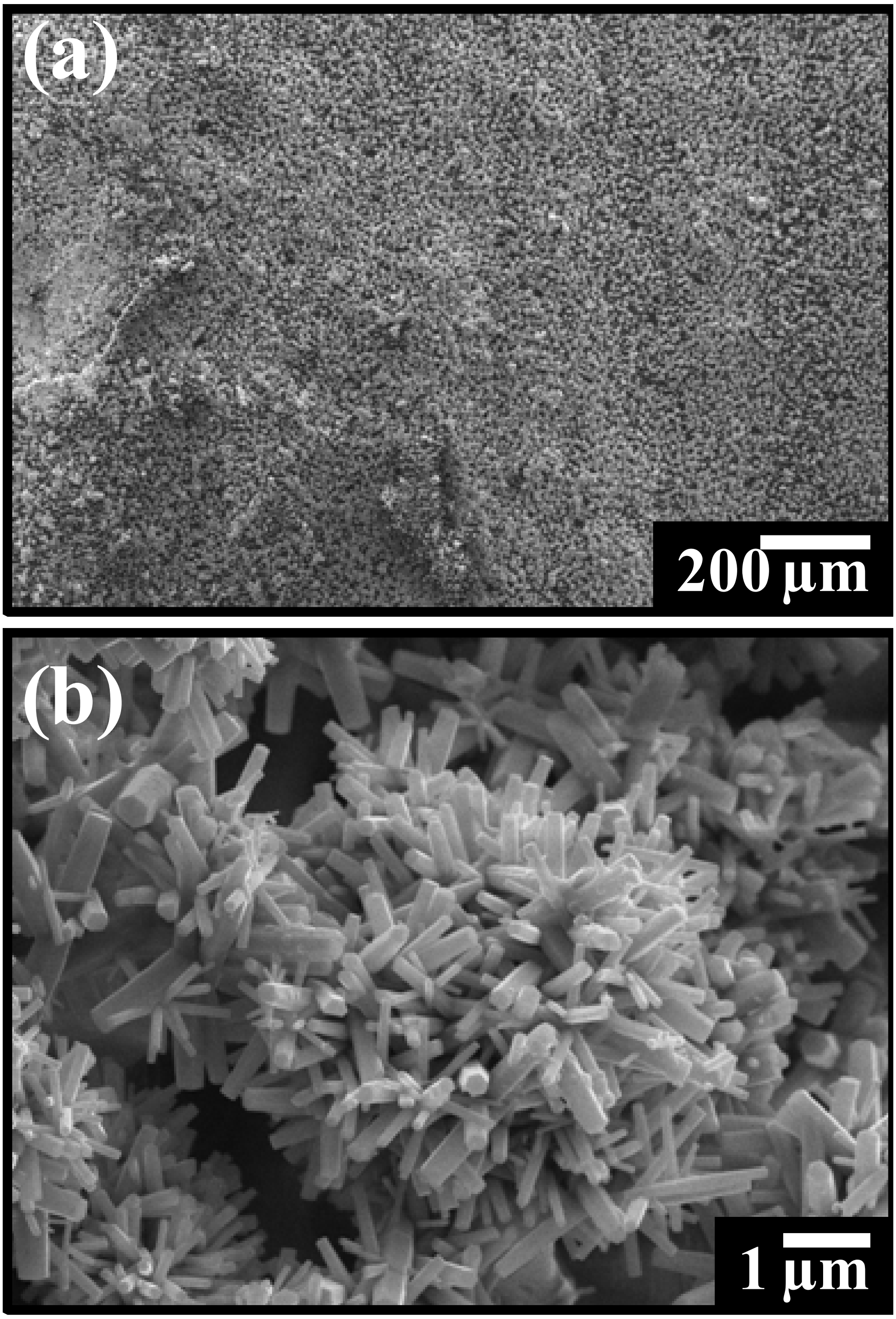


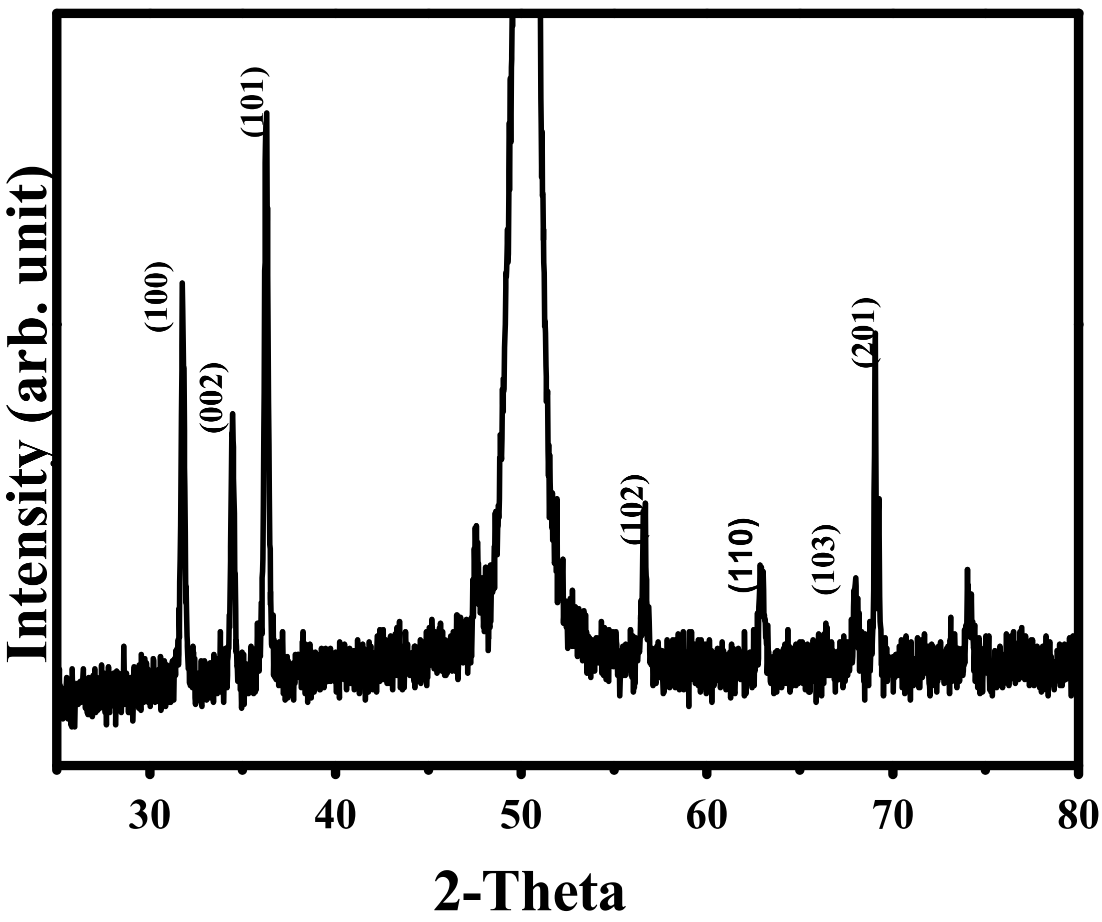
Supporting Information, S1; Pretreatment of lotus leaf before the growth: (a) Papilla structure of lotus leaf before the alcohol treatment. (b) Papilla structure after alcohol treatment; removed waxy crystalloids from the surface. (Scale bar is 2 μm). The substrate (collected from nearby local lakes) is immersed in ethanol and heated at 75 ºC under vigorous stirring for 25–30 min. The resultant was a greenish white lotus leaf with consistent morphological properties. This process could remove the contaminants on the lotus leaf and avoid extractions from the leaf impeding the growth of ZnO nanowires on the lotus leaf. The FESEM analysis of as treated lotus leaf indicates that top morphology of the leaf remained the same with removal of epicuticular waxy crystalloid.



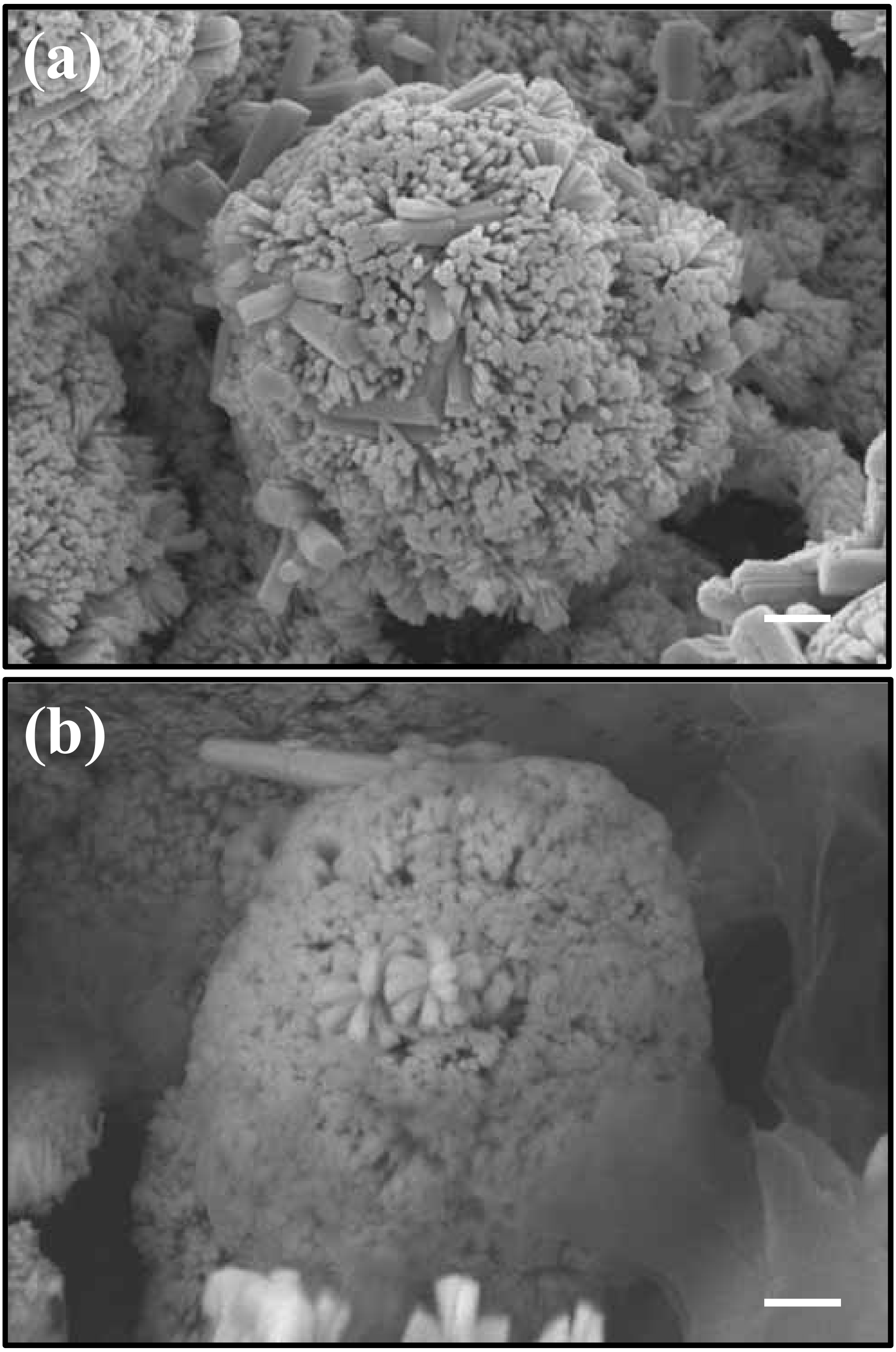
Supporting Information, S2; FESEM images of ZnO nanorods grown on lotus leaf surface at different molarity of growth solution (Zinc nitrate and HTMA) at 90 ºC for 80 min. (a) 15 mM, (b) 20 mM, (c) 30 mM, and (d) 50 mM (Scale bar is 1 μm). The length, diameter and morphology of the ZnO nanostructures can be controlled to an extent by the modifying growth parameters such as growth temperature and precursor solution molarity. The size of the nanowire increases linearly with growth time and the diameter could be tuned below 100 nm, by combining suitable growth solution molarity and temperature.



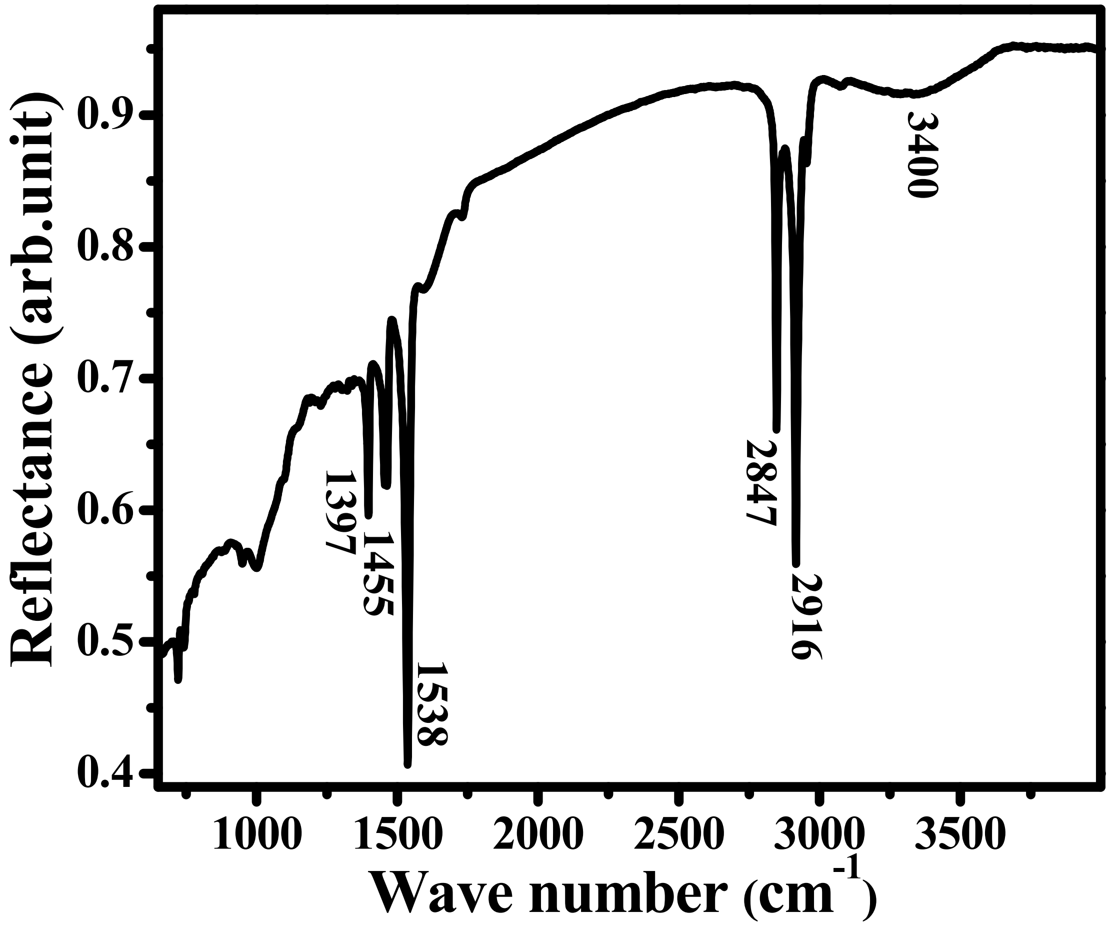
Supporting Information, S3; ZnO nanowires grown on lotus flower petals: (a) Low magnification FESEM image of ZnO nanorods grown on lotus flower petal. (b) High magnification FESEM from the papilla of a lotus flower petal.



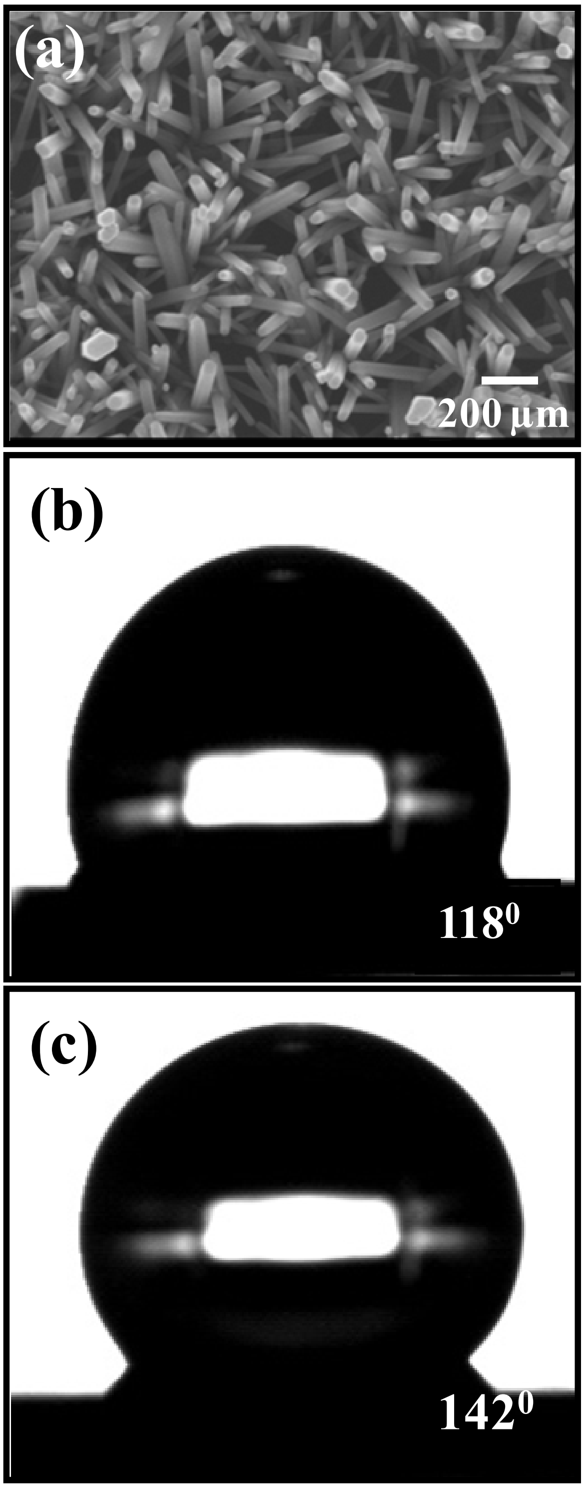
Supporting Information, S4; ZnO nanowires grown on lotus leaf: XRD spectrum taken from the ZnO nanorods on the lotus leaf surface



Supporting Information, S5; Surface fictionalization of ZnO nanowires grown on lotus leaf: (a) FESEM image of ZnO nanorods on lotus leaf taken (a) before and (b) after surface treatment with stearic acid (Scale bar is 1 μm). A thin layer of waxy hydrophobic layer is formed on the ZnO nanowire arrays.



Supporting Information, S6; ATR-FTIR spectrum recorded from the top of a stearic acid treated ZnO nanowires grown on lotus leaf. Here apart from the peaks for the blank lotus leaf structures, the intensities corresponding to the C-H stretching modes (peaks in the 2800–3000 cm^{-1}) are comparatively sharp. The increased sharpness of the peaks at 2850 cm^{-1} (CH_2) and 2916 cm^{-1} (CH_3) indicate the long chain aliphatic group in well packed self assembled layer. Furthermore, the peaks in the range of 1390−1540 cm^{-1} could be attributed to the symmetric and anti symmetric carboxylate ion COO^- stretching modes.(Reference 28 and 29 in main text) The stearate might be coordinating with Zn^{2+} in the form of chelated bindentate form.



Supporting Information, S7; ZnO nanowires grown on silicon substrate and their contact angle measurements: (a) FESEM image of ZnO nanorods on silicon substrate. (b)Water drop shape and contact angle and (c) nanowire functionalized with stearic acid. The ZnO nanowires grown on Si substrates showed high hydrophobicity and the nanowire functionalized with stearic acids enhances the superhydrophobic nature. The ZnO nanowire on the Si substrates showed water repellency instead of high adhesive behavior.