Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The Static and Dynamic Wetting of Si Nanorod Arrays[1] JIANGUO FAN, YIPING ZHAO — The wettability of a solid state surface is affected by both the surface roughness and the surface chemical composition. Here, we report a systematic investigation on the static and dynamic wetting of vertically aligned Si nanorod arrays with different heights (aspect ratio) fabricated by the glancing angle deposition technique. For as-deposited hydrophilic films, there was a contact angle transition from a rough surface to a hemi-wicking porous surface at normal film thickness $d = 500$ nm; while for the HF treated hydrophobic films, a transition from partial composite to composite surface was observed at the same film thickness. The observed results can be reasonably interpreted within framework of the classic Young's theory. We have also observed that for the hydrophilic nanorod arrays, the spreading of the water droplet causes the bundling of Si nanorods, and generates intriguing percolation patterns that change with the spreading diameter. The dynamic spreading process of a water droplet on the same surface has been recorded by a fast CCD camera, and scaling laws of the contact line, the precursor rim, and the spreading speed have been observed. Models based on capillary force, mechanical bending, as well as flow in a groove, have been proposed to qualitatively explain all the phenomena observed.

[1]work supported by NSF

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Date submitted: 28 Nov 2005 Electronic form version 1.4