Investigation of ATR-FTIR-based wetting characterization for nano-patterned surfaces

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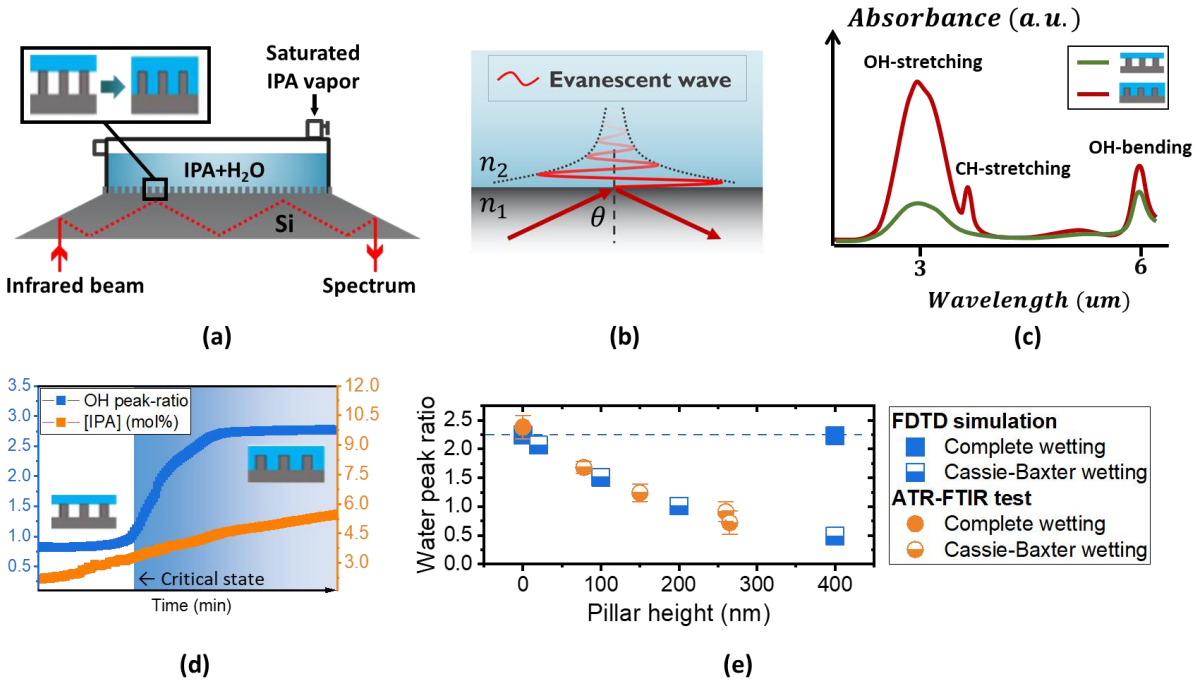
The study of wetting mechanisms on patterned surfaces is critical for surface cleaning and functional surface design. We accurately characterize the complete wetting and Cassie-Baxter wetting states on nano-pillar patterned surfaces through an ATR-FTIR-based optical method. The dynamic evolution of the wetting state transitions is also monitored in situ. In addition, through experimental measurements and optical simulations, we verified the technique's sensitivity dependence on pattern geometry. This investigation provides a valuable reference for applying this ATR-FTIR-based technology to more complex nano-texted surfaces.



(a) Sketch of the ATR-FTIR-based wetting state characterization experiment set-up.

(b) Schematic diagram of the energy distribution of the evanescent wave excited with IR light total reflection.

(c) The IR absorption spectra of complete and Cassie-Baxter wetting states.

(d) In-situ monitoring of the peak intensity ratio of the OH-stretching peak / OH-bending peak and the IPA concentration.

(e) The pillar height dependence on the water peak ratios from FDTD simulations, and ATR-FTIR measurements. The dashed line shows the consistent peak ratio for different pattern heights in the complete wetting state.