Electronic Supplementary Information

Direct Observation of Asphaltene Nanoparticles on Model Mineral Substrates

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Contents

1. Effect of deposition method on the topography of asphaltene films

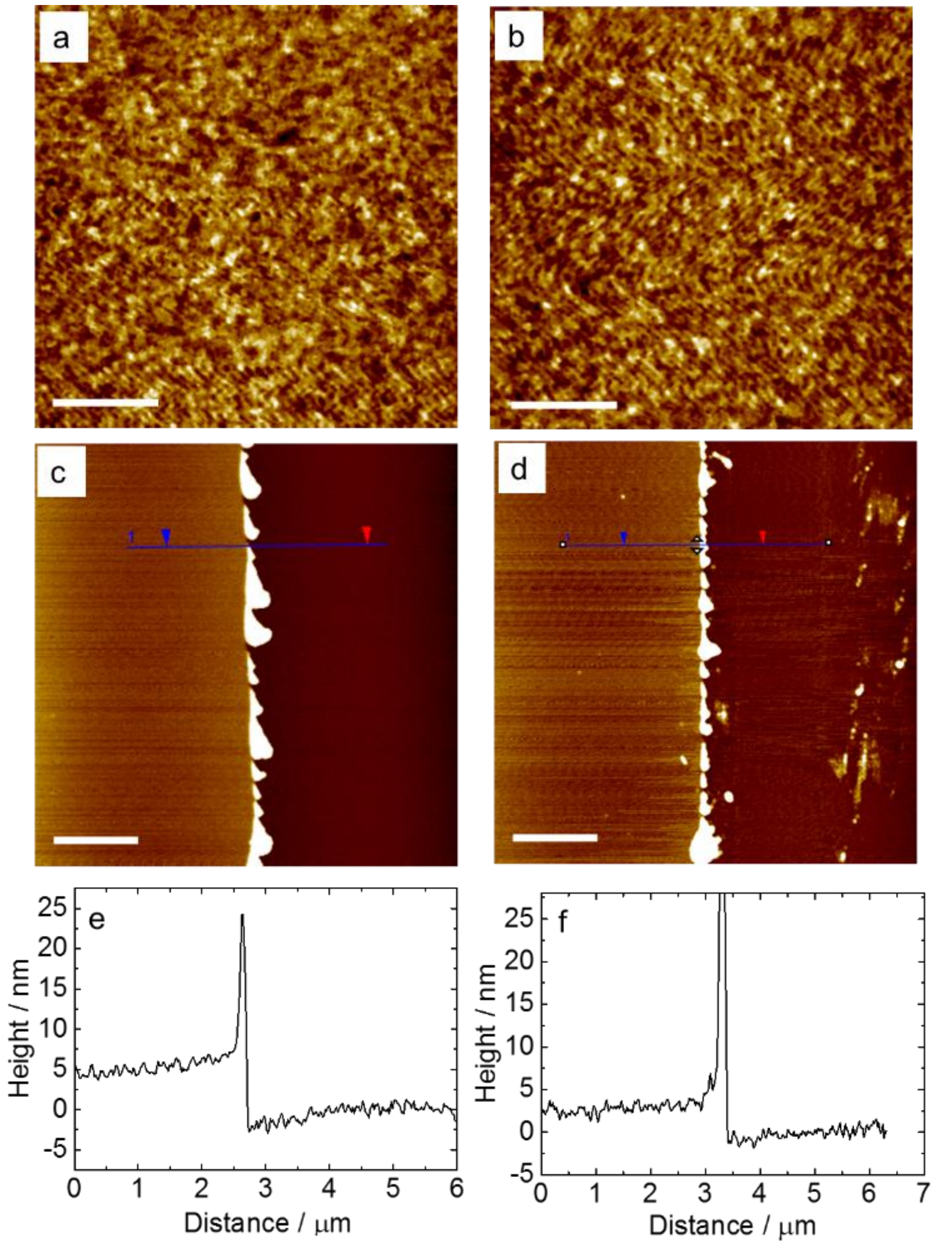

Figure S1. AFM topography images of asphaltene films (*w* = 0.05%) deposited on mica. The samples were deposited by drop-casting (a) and by spin-coating (b). Panels c and d show the AFM images of a scratch made on drop-cast and spin-coated films, respectively. Panels e and f show the cross-sectional analyses of the scratches shown in panels c and d, respectively. The length of the scale bars in panels a and b is 500 nm, and in panels c and d is 2 μm.

2. Concentration effect on the morphology of asphaltene deposits

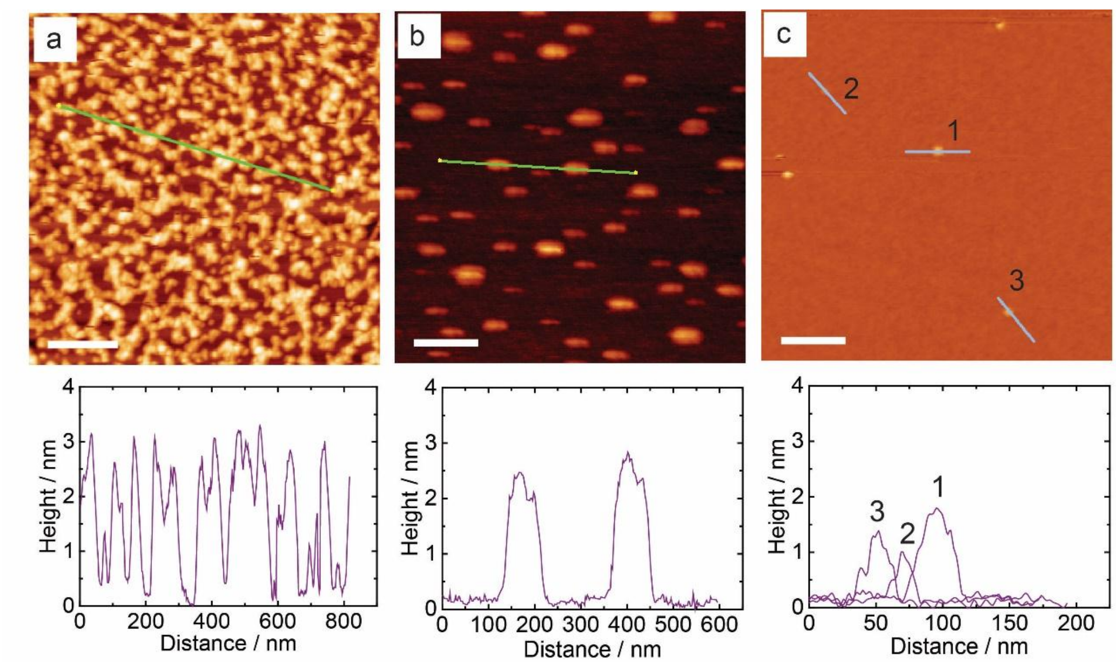

Figure S2. **Concentration effect on the morphology of the asphaltene deposits**. AFM topography images of asphaltene solutions with concentration $w = 0.04\%$ (a), $w = 0.001\%$ (b), and $w = 0.00001\%$ (c) deposited on mica. Cross-section profiles along the straight line in the topography images are shown below each image. The length of the scale bars in panels a–c is 0.2 μm. Color gradient: 0–5 nm.

3. Concentration effect on the morphology of the asphaltene deposits on calcite

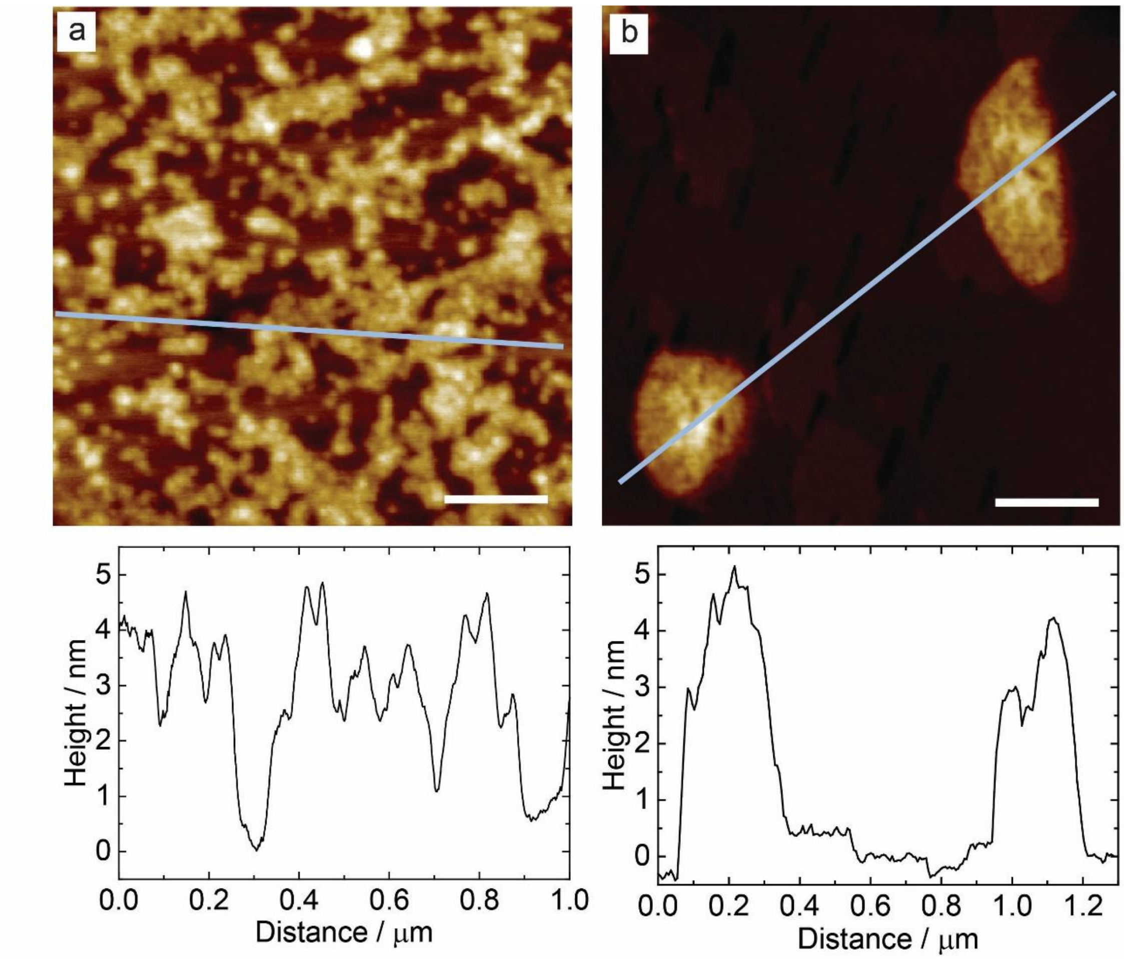

Figure S3. **Concentration effect on the morphology of the asphaltene deposits on calcite**. AFM images of asphaltenes deposited on calcite surface from toluene solutions with concentration w = 0.04% (a) and w = 0.005% (b). Cross-section profiles along the straight line in the topography images are shown below each image. The length of the scale bars is 0.2 μm. Color gradient: 0–6 nm.

4. Comparison of the force-distance profiles obtained on freshly cleaved surface of mica and HOPG

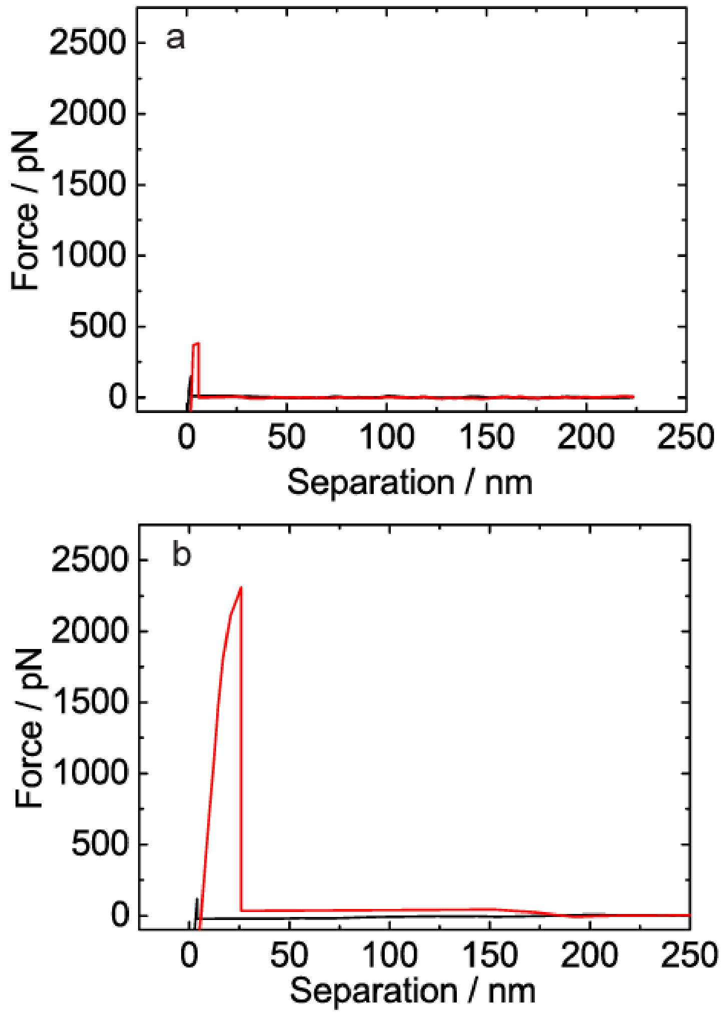

Figure S4. Force-distance profiles obtained on uncoated substrates. (a) Freshly cleaved mica, and (b) HOPG.

5. Comparison of DPFM topography, adhesion and stiffness channels of asphaltene deposit on freshly exposed surface of a calcite crystal

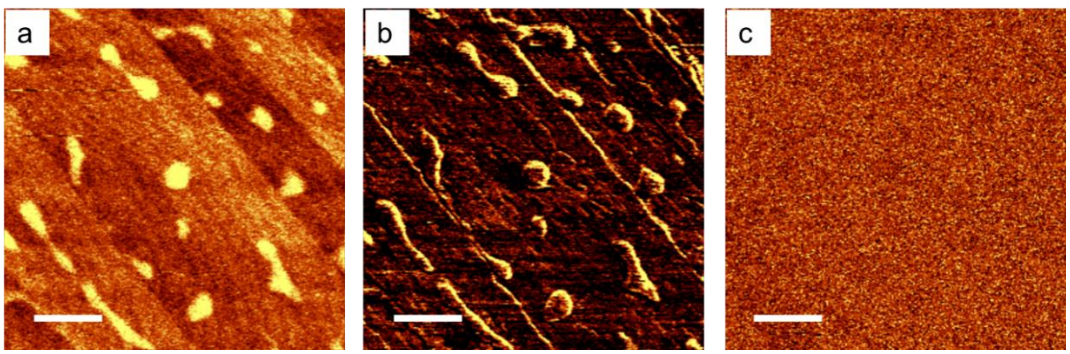

Figure S5. DPFM imaging of asphaltenes (*w* = 0.005%) deposited on freshly exposed surface of calcite crystal. Topography (a), adhesion (b) and stiffness (c) channels are shown. Unlike adhesion, the stiffness channel shows lower contrast between asphaltene nanoaggregates and calcite. The length of the scale bars in panels a–c is 1 µm. Color gradient: a, 0–6 nm; b, 0–0.09 V; c, 0–0.13 V.