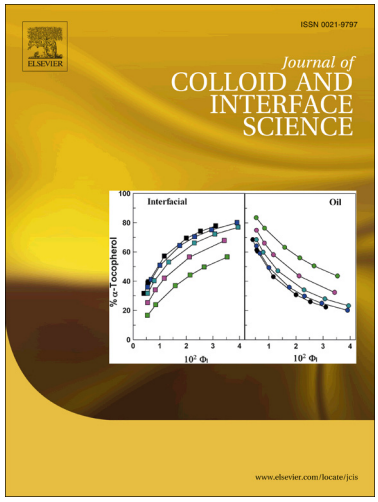

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Superhydrophobicity: Cavity growth and wetting transition

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ABSTRACT

We show by using AFM colloidal probe microscopy (combinations of hydrophobic/superhydrophobic as probe/surface) that superhydrophobicity displays a set of specific events when compared with hydrophobicity. Both attraction (due to capillary and wetting forces) and repulsion (most likely due to repelling air/vapor layers or micro-/nanobubbles) occur upon approach and when surfaces are pulled apart both shorter range (50-100 nm or more) and longer range (several micrometers) attractive forces are displayed. The interaction is explained by forces generated through the formation of air and water vapor cavities, in the shorter-range (>50 nm) case maintaining a constant volume of the cavity, in agreement with calculation of capillary forces, and in the longer-range (>1 μm) case through access of air to the cavity, in agreement with thermodynamics of cavity growth. An added sodium dodecyl sulphate surfactant gave a partially reversible wetting transition and reduced the longer-range interaction to shorter-range, suggesting a transfer from the Cassie-Baxter to the Wenzel wetting regime. The