HOW TRIPLE LINE PINNING AFFECTS WETTING ON TEXTURED SURFACES

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We have explored the kinematics of triple line depinning on textured surfaces. To that aim, we have designed various surfaces, changing periodic surface patterns or texture inclination. Dynamic textures have also been developped for local modulation of the triple line boundary conditions. We have observed the relation between macroscopic contact angle and local triple line kinematics. For a better understanding of the results, numerical models using standard surface energy minimization techniques have also been implemented.

For periodic superhydrophobic surfaces, we have found that the receding contact angle is controlled by point defects of the triple line, which adjusts between consecutive rows through kinks. These kinks mediate line depinning and control the receding contact angle[1]. We have also shown that they give rise to surface fraction scaling, as found in the Cassie equation, but also explain the shortcomings of the Cassie equation at low surface fractions[2]. This new kinematics is also useful to underestand drop motion on dynamic surfaces, as we have recently demonstrated through magnetically actuated textures.

Finally, we have explored the impact of texture inclination in the Wenzel state. We show that for inclined textures, the triple line can unexpectedly move only “against the nap”, i.e. opposite the direction in which the textures point[3]. The evolution of the advancing contact angle with inclination can only be explained by a 3D calculation of pinning.

In all these cases, simple rules of mixture do not satisfactorily account for the data and the concept of line pinning has to be called in to reach a succesfull understanding of dewetting.

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