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Observation of the Breaking of the Dynamic Wetting Line under Vacuum

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Abstract

All available dynamic contact angle theories [1] suggest that the dynamic contact angle will not be much (or even at all) affected by the viscosity of the air. In other words, the viscosity of the air plays no role its entrainment when the wetting line breaks. Dynamic wetting experiments at the lowest vacuum attainable are fundamental in that they can help us unravel the effect of air viscosity or other surrounding gases on entrainment when dynamic wetting failure occurs. In our previous unique experiments [2] where we reduced the air pressure and recorded a reduction in air entrainment velocity, we demonstrated that the air is indeed important in air entrainment with the implication that the contact angle and other aspects of dynamic wetting may be affected by the viscosity of the air or the surrounding gas.

In this paper, we follow-up on our initial study, using the same equipment [2], and present data on how the air pressure affects the velocity dependence of the contact angle and the slope angle of the saw-tooth wetting line, the two most fundamental features of wetting. Remember the slope angle of this line defines the maximum speed of wetting [3] (the speed at which the wetting line advances normal to itself) and we have demonstrated how by manipulating the flow geometry we can postpone air entrainment to higher speeds [4], but whether this maximum speed is the speed at which the contact angle gets to 180 deg or a lower speed has not been established.

References

1. Blake, T.D. (1993) "Dynamic Contact Angles and Wetting Kinetics", in "Wettability", J. Berg (Ed.), Marcel Dekker, New-York, pp. 252-309.
2. Benkreira, H. (2004) "Dynamic Wetting under Vacuum", 12th International Coating Science and Technology Symposium , September 20-22, 2004, Rochester, New York, USA
3. Blake, T.D. and Ruschak, K.J., "A Maximum Speed of Wetting", Nature, 282, 489 (1979)
4. Benkreira, H and Cohu, O., 1998, Angling the dynamic wetting Line retards air entrainment in pre-metered coating processes", AIChE Journal, 4(5), 1207-1209.

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