

表面与界面工程

## 粗糙表面上的移动接触线和动态接触角

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**摘要** 提出一个粗糙表面上移动接触线和动态接触角的数理模型: 毛细数较低时表观接触线前缘存在极薄的前驱膜, 表观接触线在“湿”固体表面上移动, 不同于传统模型中认为表观接触线在“干”固体表面上移动. 在Moffatt角区内部流动解的基础上, 通过引入接触线特征参数表征表观接触线在前驱膜上的滑移程度, 导出动态接触角的速度关系. 与不同研究者实验数据对比发现量纲1特征参数反映固体材料特性和表面特性对动态湿润过程的影响, 与液相的性质无关. 结合前期提出的滞后张力模型, 对动态法和静态法测量静接触角产生的差异给出合理解释.

**关键词**

[动态接触角](#) [应力奇点](#) [特征参数](#) [前驱膜](#)

分类号

## MOVING CONTACT LINE AND DYNAMIC CONTACT ANGLE ON ROUGH SOLID SURFACES

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### Abstract

A model to describe the motion of contact line and dynamic contact angle on rough solid surfaces was proposed. It was assumed that a precursor film exists ahead the apparent contact line (ACL) at small velocities of ACL or capillary numbers. The ACL moves on the “wetted” solid surface, rather than “dry” solid surface as expected in the conventional hydrodynamic theories. With introduction of the contact line characteristic parameter,  $\lambda'$ , describing the slipping degree of ACL on the precursor film, the relationship between the dynamic contact angle and the velocity of moving contact line were derived. The comparison of the experimental results with the model indicates the dimensionless characteristic parameter,  $\lambda$ , can describe very well the effect of the solid material and surface properties (roughness *etc.*) on dynamic wetting processes, and is independent of liquid properties. The difference of static contact angles measured by the dynamic measurement technique from static measurement technique was interpreted by this model and the previous hysteresis tension model.

**Key words** [dynamic contact angle](#) [stress singularity](#) [characteristic parameter](#) [precursor film](#)

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