# Continuous and Discontinuous Filling of a Wedge: Understanding Wetting of Rough Walls

G. Giugliarelli
*Diepartimento di Fisica*
*Università di Udine*
*I-88100 Udine, Italy*
and
*INFM – Unità di Padova*
*Padova, Italy*

A.L. Stella
*INFM – Dipartimento di Fisica*
*Università di Padova*
*I – 35131 Padova, Italy*

Wetting properties of wedges [1] are studied in terms of a simple interfacial model on a 2D square lattice, with short range interface-wall interactions. Thermodynamics and interface height ditributions are obtained by transfer matrix methods, either exactly, or numerically. Two different kinds of wedges are considered: simple wedges formed by two straight walls with opposite slopes; composite wedges formed by similar walls, in which a small hill is placed at the bottom of a simple wedge. For simple wedges a continuous filling transition is always found at a temperature which is a decreasing function of the wedge opening angle. The phase diagram shows also that, at low temperature, reentrant wetting take place [2]. On the contrary, for composite wedges, the filling transition is always found discontinuous. In this case, both the interface-wall contact probability and the average interface height undergo a sudden, discontinuous jump at the transition temperature. Moreover, at this temperature the interface height distribution shows a double peak structure. The change in the nature of the transition induced by the above geometrical modification of the wedge shape recalls and elucidates the similar, remarkable phenomenon occurring in the wetting of self–affine rough substrates [3]. Such wetting changes from continuous to first–order as the roughness increases. We tested the analogy by considering composite wedges with a depth $\Delta H$ scaling with the wedge opening size $L$ as $\Delta H\ L \sim L^{\zeta}$. For these wedges the order of the transition is a function of the exponent $\zeta$. As in the case of self–affine subtrates, we obtain that, while for $\zeta < 1/2$ the filling transition is continuous, for $\zeta > ½$, it becomes discontinuous. The close connection between the two situations is extensively analyzed also in terms of scaling and functional renormalization group arguments.

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