

Possible origin for the experimental scarcity of KPZ scaling in non-conserved surface growth

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Abstract-

The Kardar-Parisi-Zhang (KPZ) equation is generically expected to describe the scaling properties of rough surfaces growing in the absence of conservation laws. However, very few experimental realizations are known of this universality class. Here we focus on the role of instabilities, whether of diffusional origin or other, as physical mechanisms hindering the observation of KPZ scaling. Examples are drawn from various growth processes, such as electrochemical deposition (ECD), chemical vapor deposition (CVD), and erosion by ion-beam sputtering. We moreover consider an interface equation which, starting from the corresponding constitutive equations, can be derived to describe growth by either ECD or CVD depending on the interpretation of the quantities appearing. This approach makes contact with phenomenological parameters, and suggests that a more generic description of non-conserved growth may be provided by the Kuramoto-Sivashinsky equation and generalizations thereof. In this case, the experimental scarcity of KPZ scaling would be due to exceedingly long transients determined by the instabilities that occur. (C) 2002 Elsevier Science B.V. All rights reserved.

Index Terms- kinetic roughening, kpz equation, kuramoto-sivashinsky equation, moving boundary problem, noise, ion-beam sputtering, chemical vapor deposition, elect

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