Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Liquid Film Dynamics in the Presence of Surface Heterogeneity
YONGLI ZHAO, JEFFREY MARSHALL, University of Iowa — A study is reported of the instability and growth of fingers on liquid films driven over heterogeneous surfaces. Computations are performed using a variation of the precursor-film model, in which a disjoining pressure term controls variation in static contact angle associated with surface heterogeneity. The formulation yields results approaching predictions of the Tanner-Hoffman-Voinov dynamic contact angle formula for sufficiently small values of the precursor film thickness. A modification of the disjoining pressure coefficient is introduced which yields correct variation of dynamic contact angle for finite values of the precursor film thickness. The film fingering instability is examined both for cases with random variation in static contact angle and for cases with ordered strips of different static contact angle. For the cases with random static contact angle variation, the surface heterogeneity is characterized by the correlation length and variance of the static contact angle variation from its mean value. Several different types of nonlinear phenomena, including subcritical instability and lock-on, are observed for the case with streamwise strips of varying contact angle.

Jeffrey Marshall
University of Iowa

Date submitted: 28 Jul 2005 Electronic form version 1.4