Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Viscoelastic Effect on the Spinodal Dewetting of a Thin Liquid Film LIN WU, Department of Mechanical Engineering, University of Nebraska-Lincoln, Lincoln, NE 68588 — We theoretically study the interfacial instability that leads to the spinodal dewetting of an initially flat and static viscoelastic film on a nonwetting surface via a linear analysis. The previously ignored non-Newtonian flow effect of the liquid film is modeled by the Jeffreys constitutive equation. The driving force for the spinodal dewetting is the conjoining pressure induced by the long range intermolecular force. Surface tension provides a stabilizing mechanism by resisting the deformation of the interface. The system is unconditionally unstable subject to disturbances with a wavelength larger than a critical value. The elasticity of the polymer is found to further destabilize the system. For polymer melt with a negligible solvent retardation effect, a resonant phenomenon appears as a result of the interaction between the two destabilizing mechanisms (the conjoining pressure and the polymer elasticity) when the Deborah number is above a critical value. The resonance introduces two most unstable wave numbers, at which the growth rate of the disturbance is unbounded. The two most unstable wave numbers bifurcate at a minimum Deborah number, below which no resonance is observed.

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Date submitted: 11 Aug 2005 Electronic form version 1.4