

Microstructural Evolution in Elastically Inhomogeneous Systems

A phase field study

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Section IIc

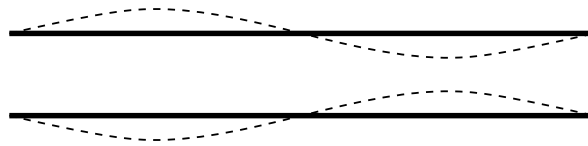
Asaro-Tiller-Grinfeld instabilities

ATG instabilities

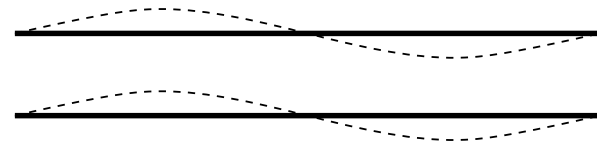
- Asaro-Tiller and Grinfeld – A solid in contact with its melt
- Srolovitz – A solid in contact with vapour
- Sridhar, Srolovitz and Rickman – a hard solid film embedded inside a compliant matrix
- Any hard surface is thermodynamically unstable as long as the phase in front of it is compliant; the lower wavelength limit of the break-up is set by interfacial energy

Thin film stability

- Volume diffusion driven
- Isotropic ($A_Z=1$)
- Types of break-up:



Symmetric



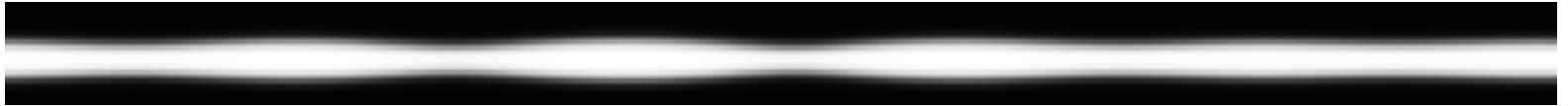
Antisymmetric

Depends on θ , the ratio of interfacial and elastic energies, and δ . The break-up is antisymmetric for higher δ .

Symmetric onset

$$\delta=2$$

Onset (t=115000)



Break-up (t=122000)



Late-stage (t=143000)



Antisymmetric onset

$$\delta=4$$

Onset (t=20000)



Break-up (t=25000)

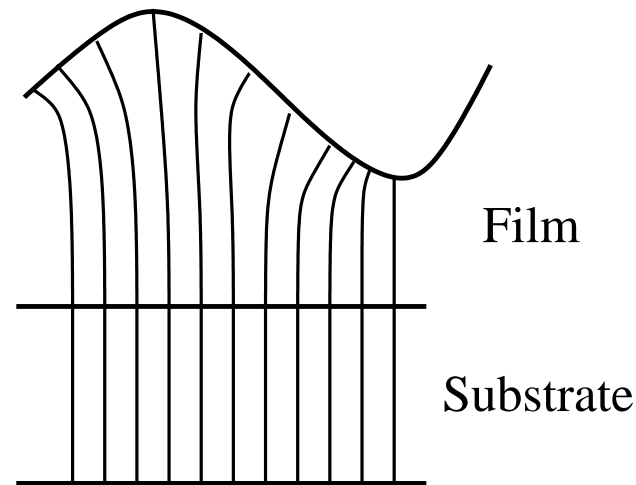


Late-stage (t=34000)



Linear stability analysis

Mullins-Sekerka volume diffusion driven instability (including elastic stress effects): to obtain λ , the maximally growing wavelength



$$\lambda \approx 102 \text{ (analytical)}$$

$$\lambda \approx 97 \text{ (numerical)}$$