Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Dynamics of a drying viscoelastic polymer solution[1] ALEXANDROS HATZIS-MPAKRATSAS, GEORGE KARAPETSAS, Aristotle University of Thessaloniki — Drying polymeric solutions with a volatile solvent are encountered frequently in technological applications. So far, a number of studies have focused on the effect of solutocapillary and thermal Marangoni effects, while the effect of the rheological characteristics of the polymeric film have been largely ignored. Polymeric solutions, though, are known to exhibit viscoelastic behavior with properties (i.e. viscosity, relaxation time) that may depend on the local concentration of the solvent. Here, we develop a theoretical model that fully takes into account the viscoelastic nature of these solutions. In the limit of slow evaporation, we perform a linear stability analysis under the quasi-steady assumption and perform an extensive parametric study. In order to examine the dynamics in the non-linear regime, we also perform time-dependent simulations, based on a finite element formulation. Our numerical results indicate that the increasingly important effect of viscoelasticity (due to the continuous increase of the polymer solute concentration) destabilizes the flow and also leads to patterns with smaller wavelengths. Finally, we discuss the mechanisms which give rise to these instabilities.

[1]This project has received funding from the Hellenic Foundation for Research and Innovation (HFRI) and the General Secretariat for Research and Technology (GSRT), under grant agreement No 792

George Karapetsas
Aristotle University of Thessaloniki

Date submitted: 03 Aug 2020 Electronic form version 1.4