Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Electric field induced instabilities at fluid-fluid interfaces in low conductivity, low frequency and small feature size limit PRIYA GAMBHIRE, ROCHISH THAOKAR, Indian Institute of Technology, Bombay — Electrohydrodynamic instabilities at fluid-fluid interfaces due to an externally applied electric field have become a popular field of research owing to their direct application in the field of lithography. With the advent of miniaturization, it has become critical to find new ways to reduce feature sizes to even smaller dimensions and in a cost-effective way. Researchers have been working on freezing the patterns formed when thin polymer films are subjected to electric fields, which give as low as 100 nm sized structures. Different fluids with lower surface tensions and higher conductivities are being pursued to reduce the dimensions of the pattern further. Simple linear models exist which can predict these dimensions while the final structure can be simulated. The present work addresses three cases where the linear models fail. The first case is when the thin film approximation which is a common assumption in the linear theory, becomes invalid. The second, when the charge relaxation time of the fluid is of the same order as the growth rate of the instability and the third, when the time period of the applied Alternating Current (AC) field is larger than the growth rate. In all these three cases, the regime in which the linear model fails is identified and an alternate linear model or non-linear analysis has been used to predict the observed experimental behavior.

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Date submitted: 04 Jul 2011 Electronic form version 1.4