

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Kinetics of Dewetting of Ultra-Thin Films of Organic Glasses

ZAHRA FAKHRAAI, YUE ZHANG, ROBERT RIGGLEMAN, University of Pennsylvania — Physical vapor deposition (PVD) is widely used in manufacturing ultra-thin layers of amorphous organic solids. It is generally assumed that the properties of these ultra-thin films are the same as bulk dynamics. In this work, we demonstrate that these films exhibit a sharp transition from glassy solid to liquid-like behavior with thickness below 30 nm. This liquid-like behavior persists even at temperatures well below the glass transition temperature, T_g , where bulk properties suggest that the film should be vitrified. The enhanced dynamics in these films can produce large scale morphological features during PVD and lead to dewetting instability in films held at temperatures as low as $T_g - 35$ K. We measure an effective viscosity of organic glass films by monitoring the dewetting kinetics. These measurements combined with cooling rate-dependent T_g measurements show that the apparent activation barrier for rearrangement decreases sharply in films thinner than 30 nm. These observations suggest long-range facilitation of dynamics induced by the free surface. These observations can help understand correlated dynamics in glassy systems and elucidate the processes that lead to the formation of exceptionally stable glasses.

Zahra Fakhraai
University of Pennsylvania

Date submitted: 29 Oct 2015

Electronic form version 1.4