Characterization of contact line motion during solvent evaporation, cycling breathing of triple line

Benjamin Vuillemey, Komla Ako, Yahya Rharbi
Laboratoire Rhéologie et Procédés, UMR 5520 – UJF – Grenoble INP – CNRS
Corresponding author: benjamin.vuillemey@ujf-grenoble.fr

Keywords: structured coating, convective assembly, drying, meniscus

Solvent evaporation appears as an easy way to deposit on any surface a film, which structure is directly linked to the particles contained on the suspension and its behavior with its solid and liquid environment during drying step. The coffee ring effect [1], which results in a preferential agglomeration of the particle in the drop periphery, is the most eloquent example. The deposition zone can be selected, leading to a lithography process governed by the meniscus shape [2].

Such process is difficult to assess: handling the air-liquid-substrate interface movement is a basic need to increase the technical power of that coating method. To investigate the contact line motion during drying, we focus on the meniscus which comes of a liquid flow between a sealed container and a substrate. Observations of changes regarding meniscus shape and capillary pressure, shows a cyclic phenomenon. Such breathing can be tuned in frequency and amplitude, by acting both on physical parameters of the solvents, and geometrical parameters of the device.

To increase the control of textured surfaces obtained by self-organization of particles during the evaporation process, further works will be dedicated to the selection of colloidal suspensions. Potential applications could be found in materials for optics or water repellent surfaces.

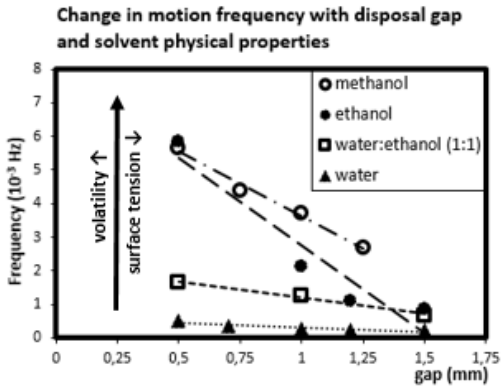

Figure 1: combined effects of solvent parameters and disposal geometry on the frequency of the contact line breathing

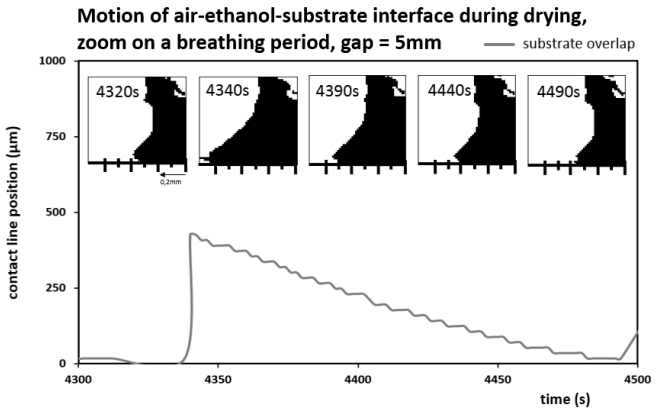

Figure 2: observed hysteresis between advancing and receding phases on a breathing cycle.

References

1. R.D. Deegan, O. Bakajin, T.F. Dupont, G. Huber, S.R. Nagel, T.A Witten, *Nature* **389**, 827-829 (1997).
2. L. Malaquin, T. Kraus, H. Schmid, E. Delamarche, H. Wolf, *Langmuir* **23**, 11513-11521 (2007).