

Experimental determination of Marangoni convection in a drying polymeric film subject to lateral variations in mass transfer

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Thin films are an essential component of novel organic electronic devices and low-cost sensors. Inhomogeneous drying conditions may result in undesired Marangoni convection and a free-surface deformation deteriorating device performance. Since surface tension of multi-component solutions or suspensions depend on both temperature and composition, control of local heat and mass transfer by means of tuning the material system or the boundary conditions while drying should lead to a homogenous solute deposition.

In order to investigate the flow field within drying thin films, a new measurement technique (μ PТВ) has been developed in preliminary studies. It is based on tracking fluorescent particles in drying polymer solutions with an inverse microscope. A technique called “off-focus imaging” allows the tracking along the line-of-sight direction, enabling us to measure three-dimensional flow fields while drying. Our measurement technique gives unique insights, which will allow us to identify process parameters crucial to the surface homogeneity of thin films and printed structures. (Tönsmann, 2019)

New results will be presented with data from a drying poly(vinyl acetate)-methanol film at different drying times. A partial cover above the film results in lateral inhomogeneous gas-sided drying conditions and therefore imposes a concentration- and surface-tension gradient. The dynamics of long-wave perturbations induced by partially covering the film as well as Bénard-like convection cells and their respective transient behavior will be presented.

References

*Tönsmann, M.; Kröhl, F.; Cavadini, P. et al. Calibration Routine for Quantitative Three-Dimensional Flow Field Measurements in Drying Polymer Solutions Subject to Marangoni Convection. *Colloids and Interfaces* 2019, 3, 39.*