EVAPORATION OF A SINGLE DROPLET IN A CIRCULAR WELL

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When a coffee drop dries on a surface, it leaves behind a solid deposit along the edge. The coffee particles which are initially uniformly dispersed throughout the entire drop, becomes concentrated near the edge, giving rise to the well-known 'coffee-ring effect'[1]. Such a ring deposit can occur in any type of solution or colloidal suspension of particles used in many industrial applications. In the coating and printing industry, the challenge is to prevent the formation of ring-like deposit in order to obtain uniform coatings or homogeneously dried ink drops.

The principles behind the evaporation of droplets, which play a key role in inkjet printing used in the manufacture of OLED displays, must be understood in order to control and predict the deposits left behind when a drop is printed onto a patterned substrate.

Single droplets of solvents with different volatility were printed inside a circular well and the influence of substrate temperature on droplet drying profile was investigated. An interferometry technique was used to provide real-time information on the changing droplet profile during drying. Droplets of different solvents printed in circular wells showed different behaviour during drying. The shape of the droplet profile (U- or W-shape) was found to be influenced by the physical properties of the solvents and by the aspect ratio of the well. Breward et al.[2] have recently developed a lubrication model to describe the evaporation of a liquid droplet inside a well. The model identifies a single dimensionless parameter which depends only from the capillary number and the aspect ratio of the well and discriminates between different drying regimes. The experimental data of single droplets evaporation, acquired for different solvents and different temperatures of the substrate, will be used to verify the correspondence between the dimensionless parameter and the different drying regimes.

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REFERENCES:

1. Deegan R. D. 'Pattern formation in drying drops' *Physical Review E*, **2000**, *61*, 475/1.
2. Breward C.J.W. et al., Mathematical Institute, University of Oxford, **2018**.