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Dynamic adsorption layer and foam film stability probed by Dynamic Fluid-Film Interferometry (DFI)

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AIM of the studies

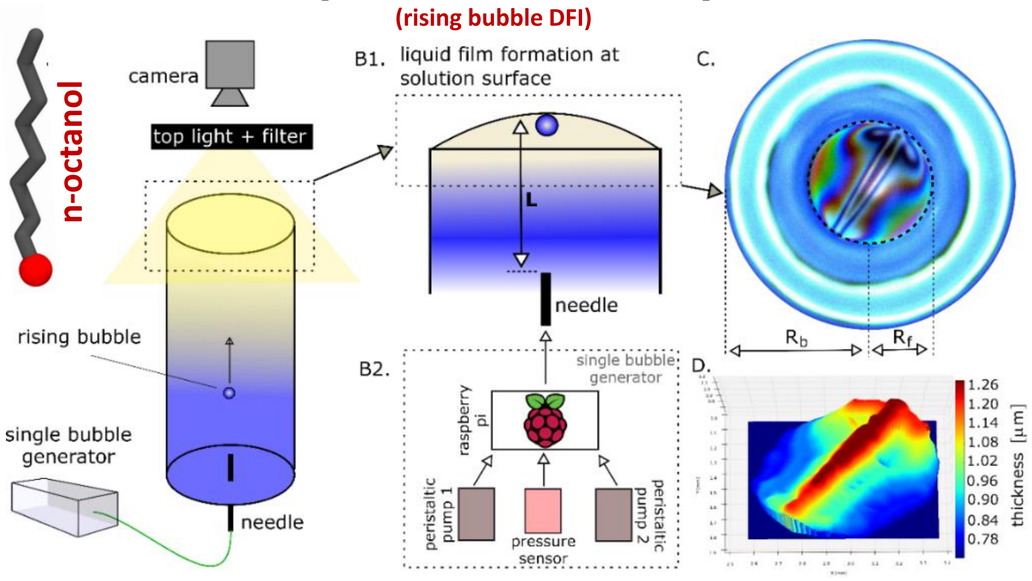
1. To determine the influence of motion-induced uneven distribution of surfactant at a rising bubble surface (dynamic adsorption layer – DAL) on kinetics of foam film drainage.
2. To obtain the results providing a first quantitative proof of the presence and influence of the dynamic adsorption layer on colliding bubble interface mobility (film drainage rate).

Dynamic adsorption layer

The DAL formation means an establishment of motion induced uneven distribution of adsorption coverage over a moving bubble interface. The state of the adsorption layer at surface of the rising bubble changes in time and depends on the distance covered by the bubble from its formation point in a surfactant solution.

Experimental set-up

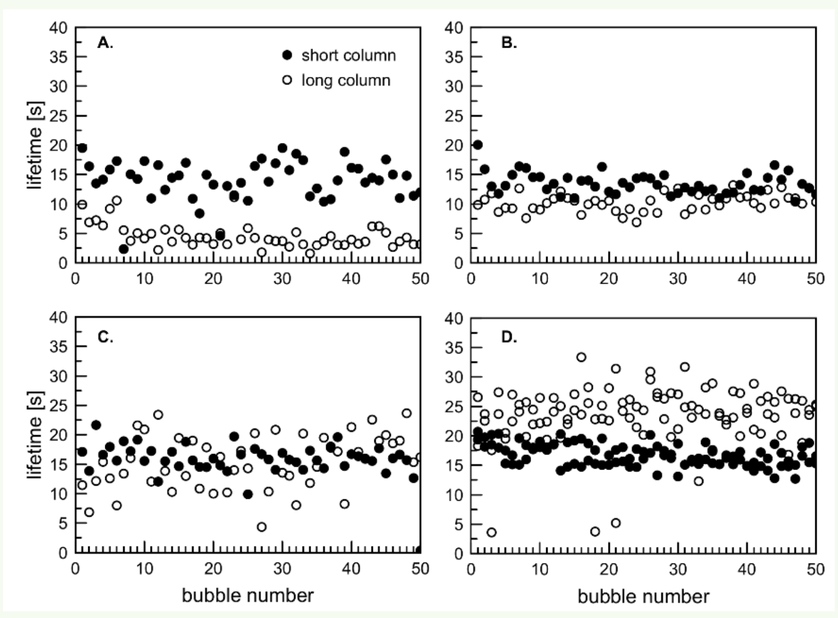
(rising bubble DFI)



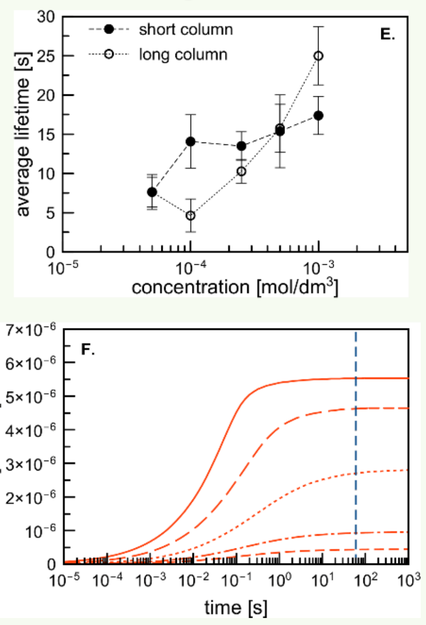
Qualitative data

(single bubble lifetime at solution surface)

Distribution of bubble lifetimes

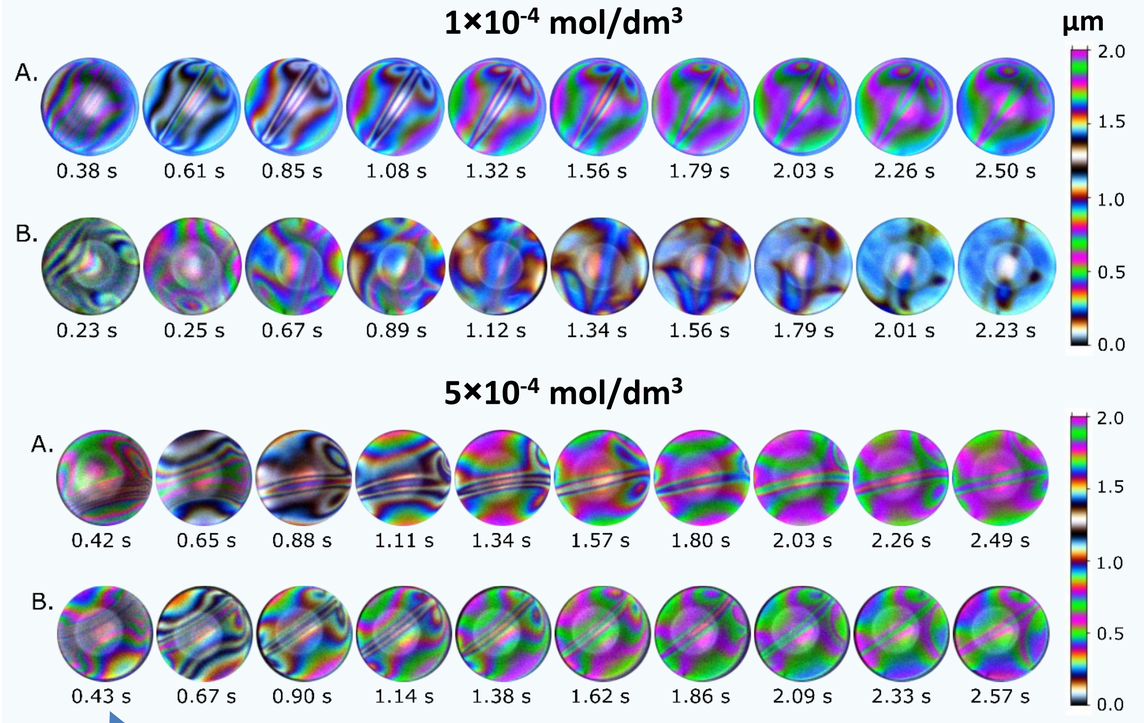


Average lifetimes

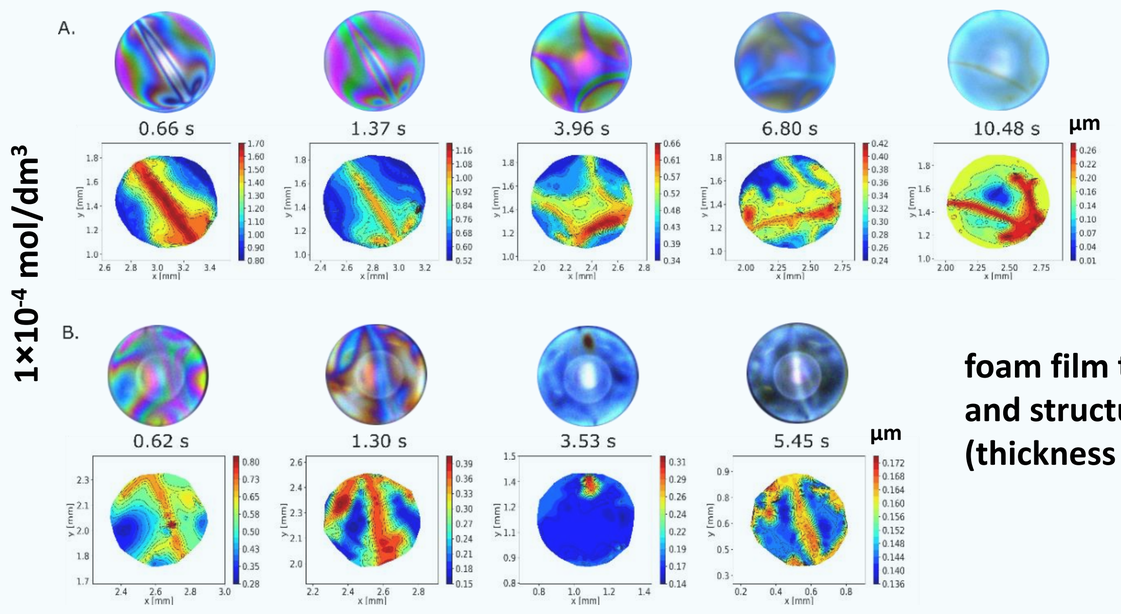


Quantitative data

(insight into the foam film structure and thickness time evolution)



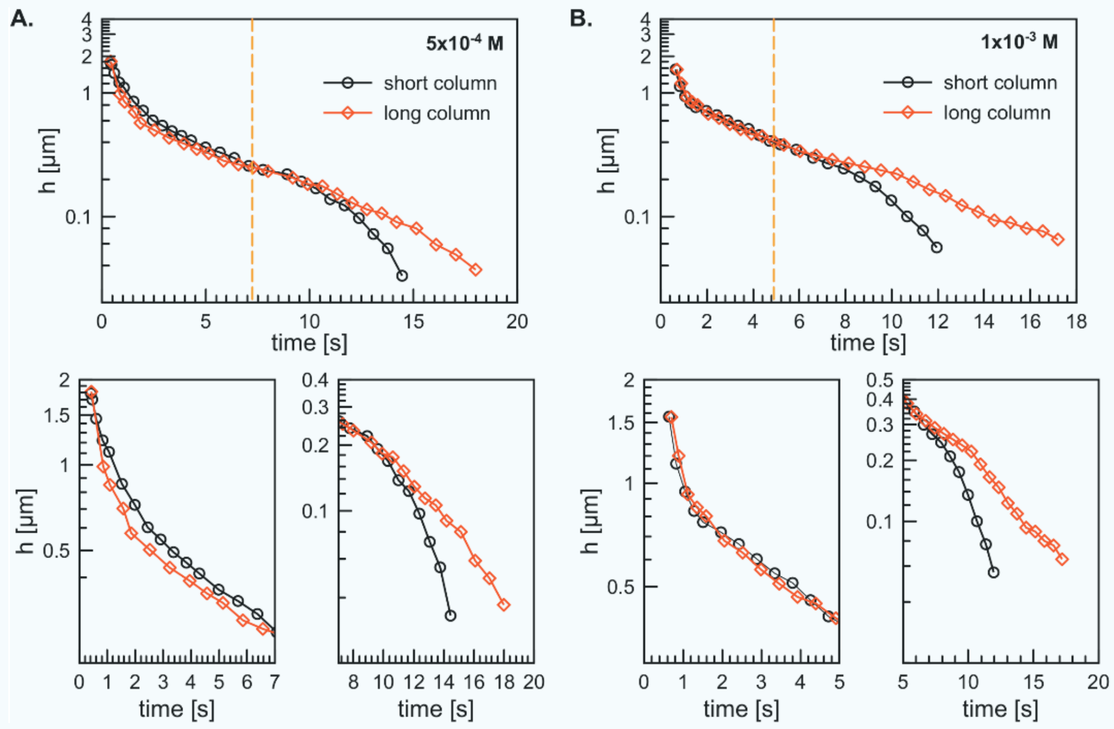
A: short column (L = 1 cm), **B**: long column (L = 40 cm)



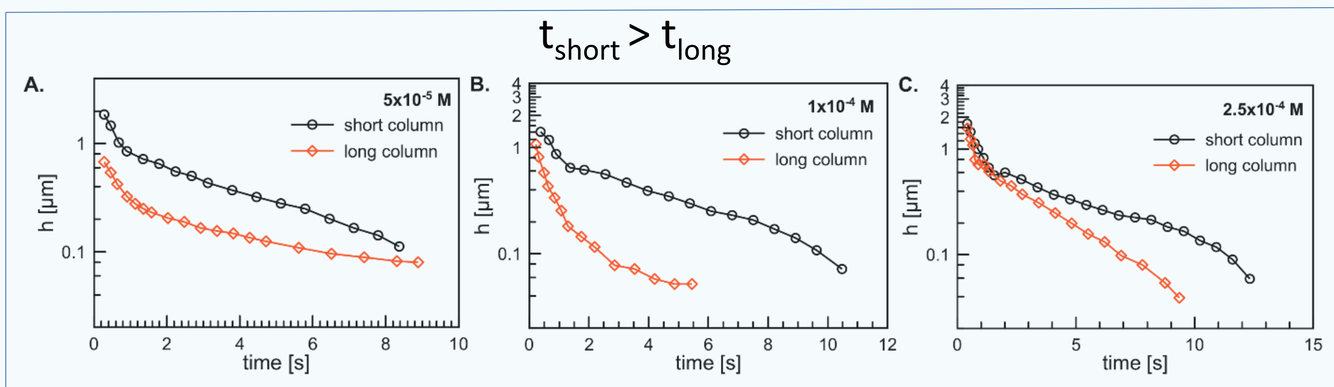
foam film topography and structure (thickness maps)

Kinetics of drainage of foam films under dynamic conditions (different DAL structure)

$t_{short} < t_{long}$



$t_{short} > t_{long}$



Conclusions:

- ✓ State of the dynamic adsorption layer (DAL) at a rising bubble surface has profound influence on kinetics of drainage of foam film formed at a solution surface.
- ✓ Modified Dynamic-Fluid Film Interferometry technique is a very powerful tool for determination of liquid film structure and thickness time evolution under dynamic conditions.
- ✓ Lifetime of a single bubble at a solution surface corresponds well to the liquid film drainage kinetics.
- ✓ Rate of drainage of a foam film formed by colliding bubble rising with different DAL structure can be higher, but magnitude of this phenomenon is surfactant concentration depended and in considering system (n-octanol solutions of concentration range: $5x10^{-5}$ - $1x10^{-3}$ M) be observed only at the drainage initial stage.

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