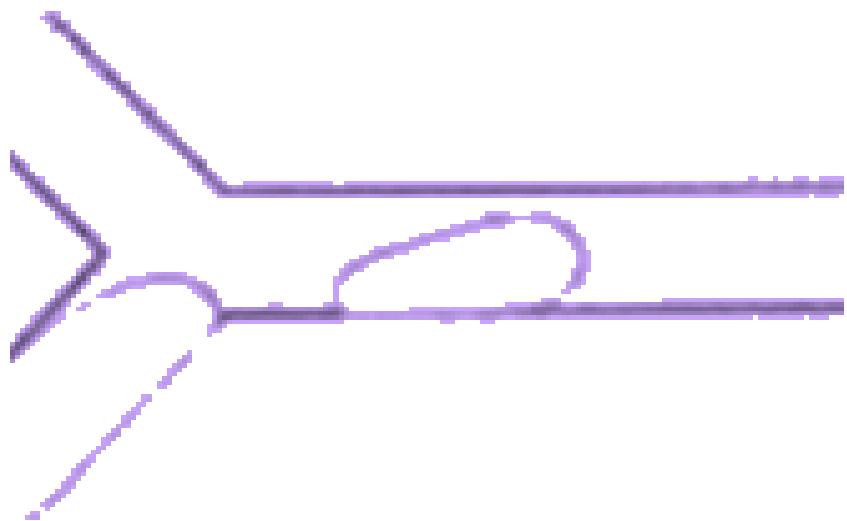


Dynamic interfacial tension of emulsions studied with a microfluidic Y-junction

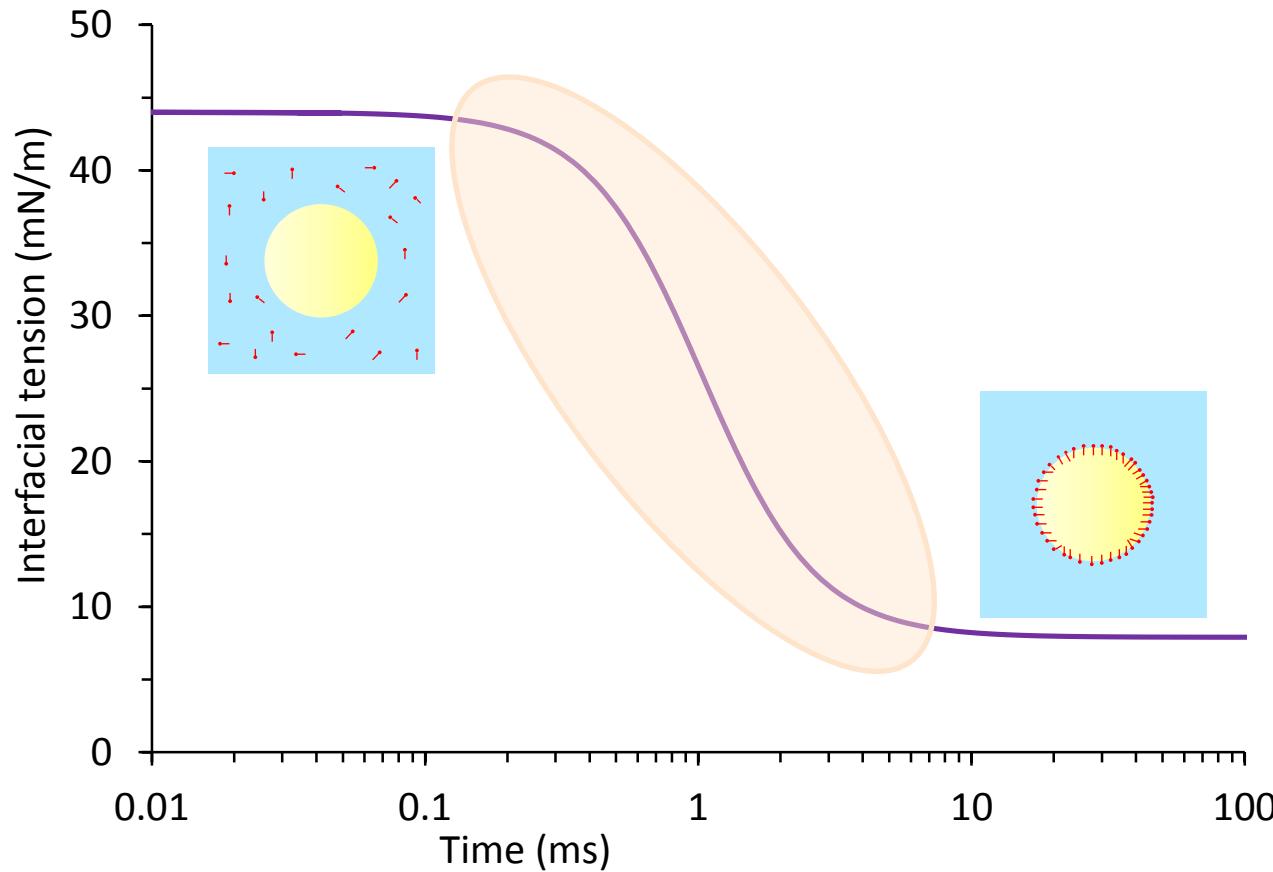
Kelly Muijlwijk, Claire Berton-Carabin and Karin Schroën

Food Process Engineering Group, Wageningen University

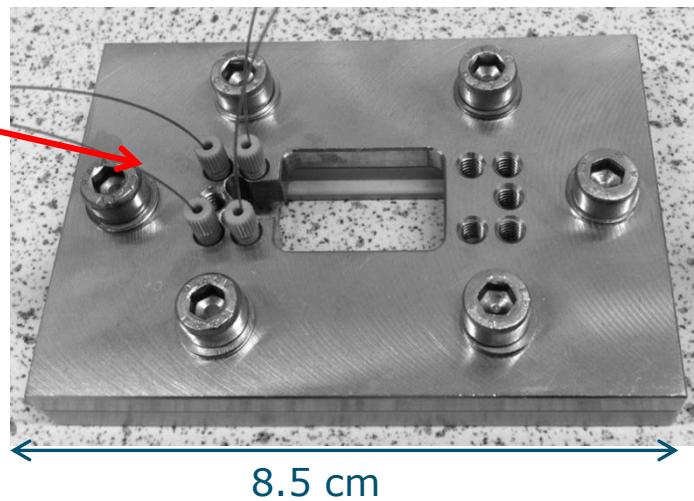
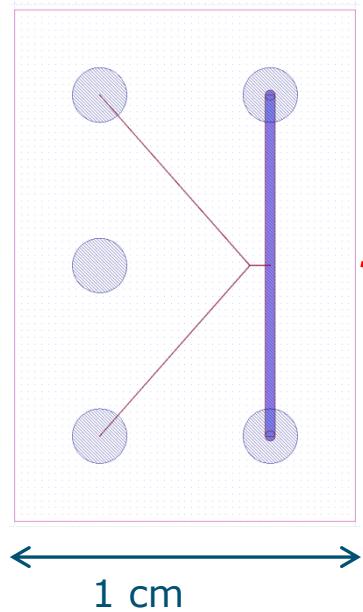
NanoCity October 6th 2015



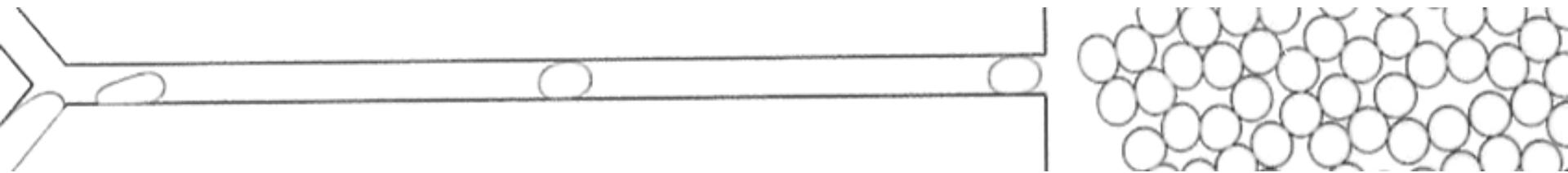
Dynamic interfacial tension of emulsions studied with a microfluidic Y-junction



Dynamic interfacial tension of emulsions studied with a microfluidic Y-junction



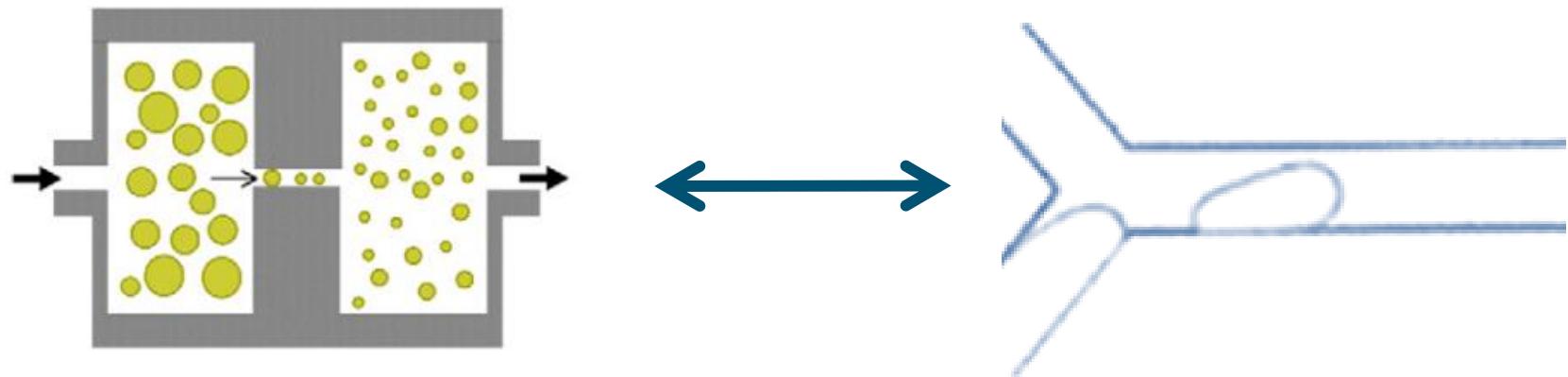
Dynamic interfacial tension of emulsions studied with a microfluidic Y-junction



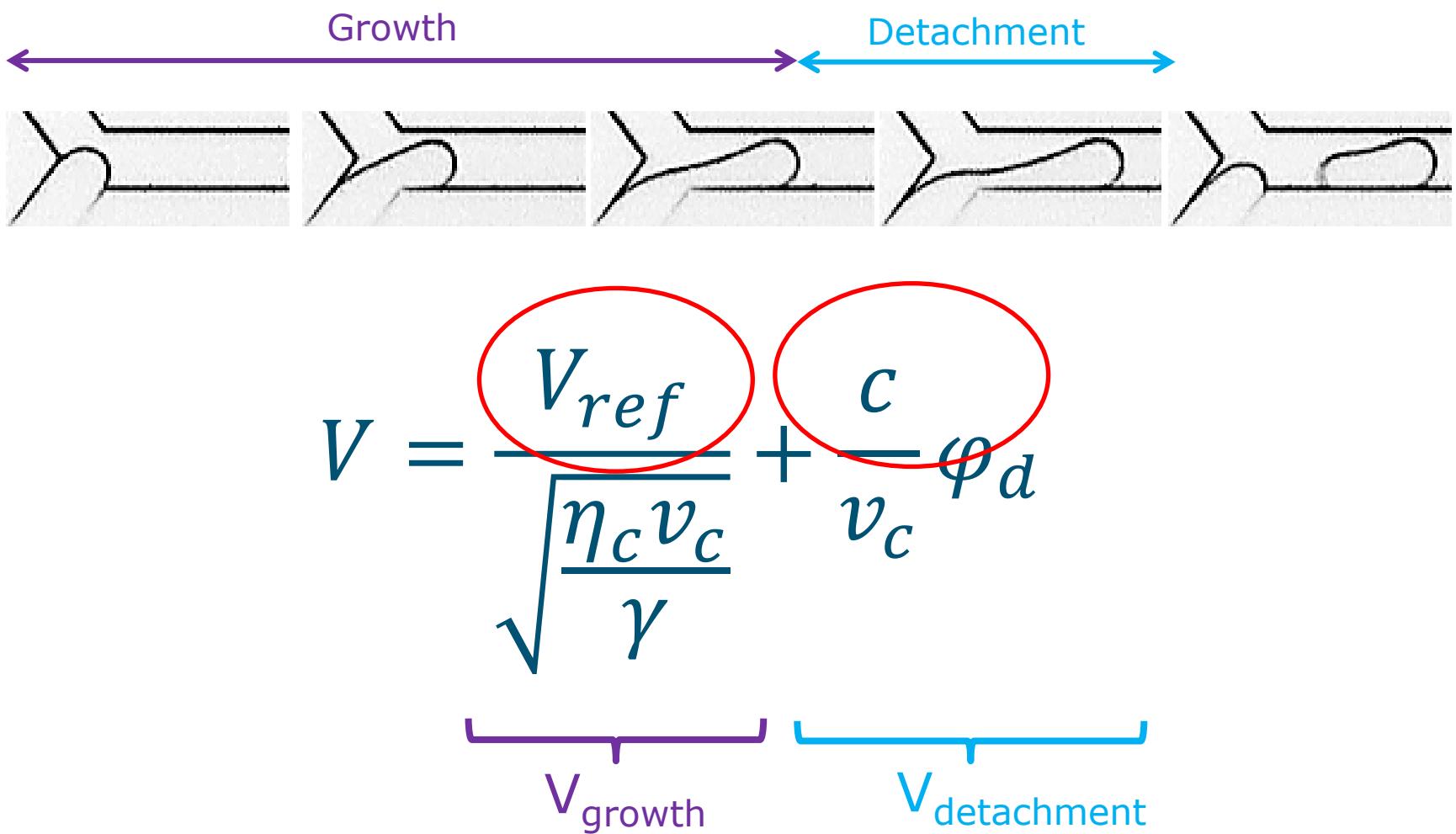
Width = 20 μm
Depth = 5 μm

Droplet formation is a balance between shear force and interfacial tension

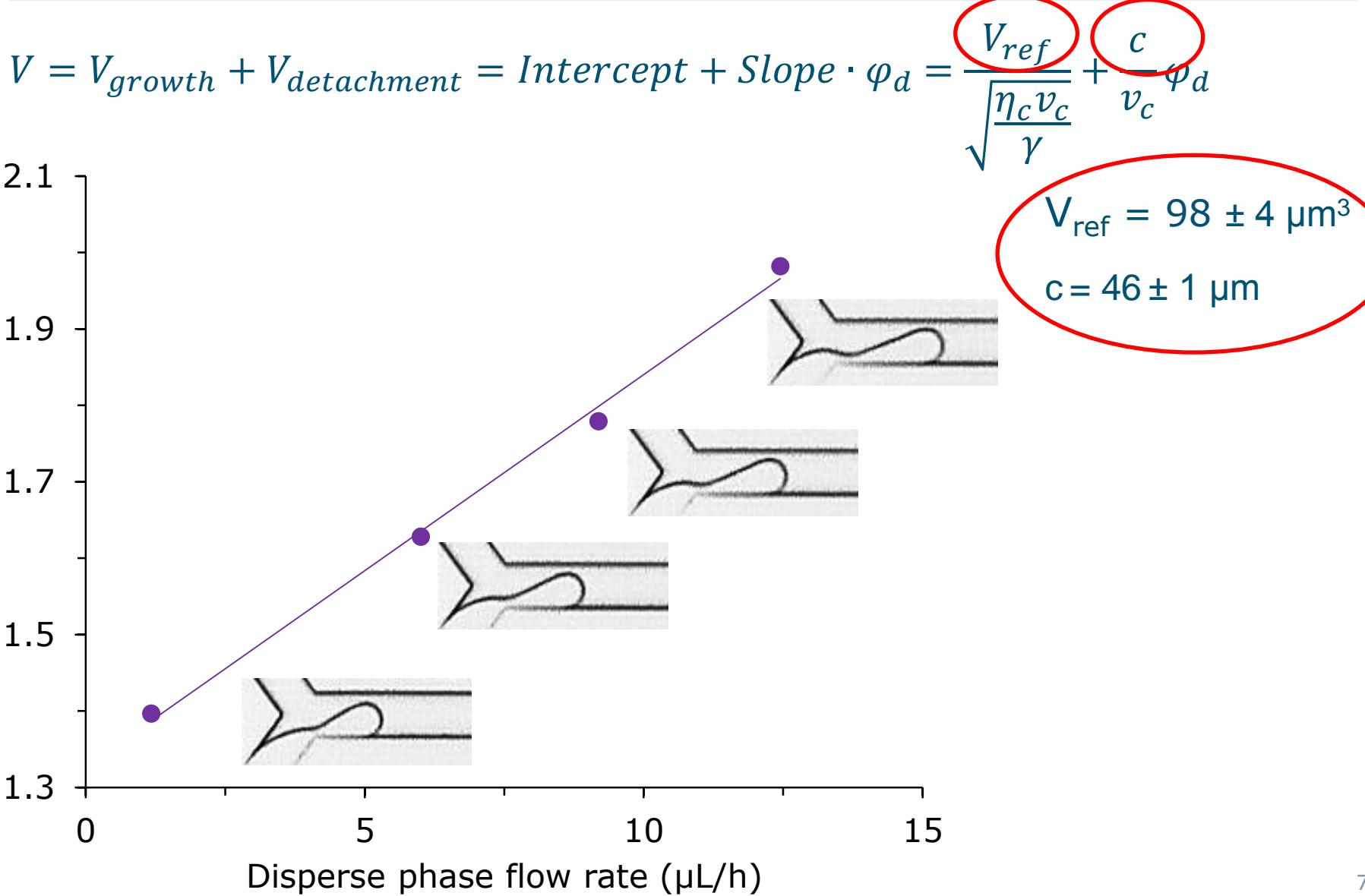
Motivation



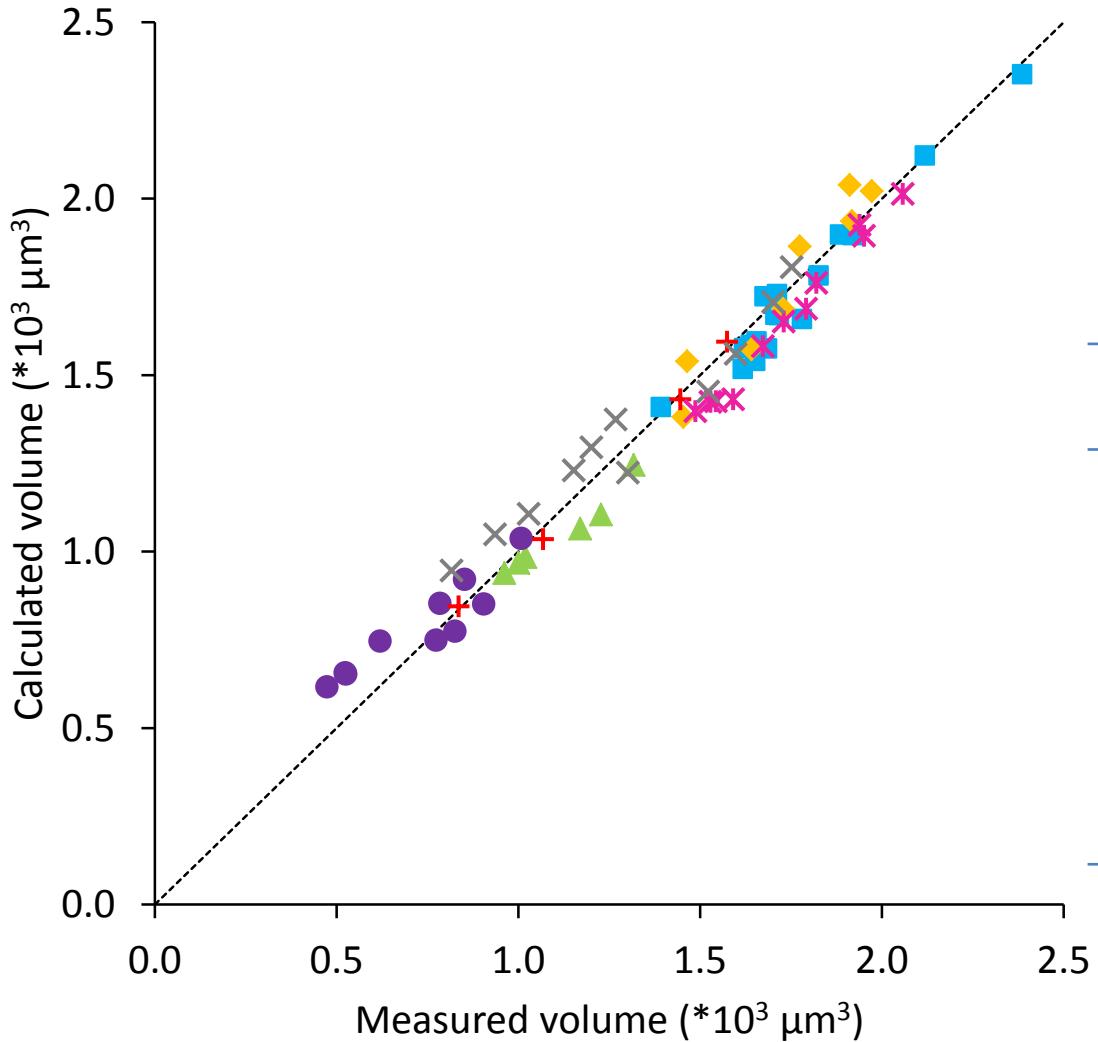
Two-step model



Model: oil-in-water



Parity plot – Prediction



$$V = \frac{V_{ref}}{\sqrt{\frac{\eta_c v_c}{\gamma}}} + \frac{d_{ref}}{v_c} \varphi_d$$

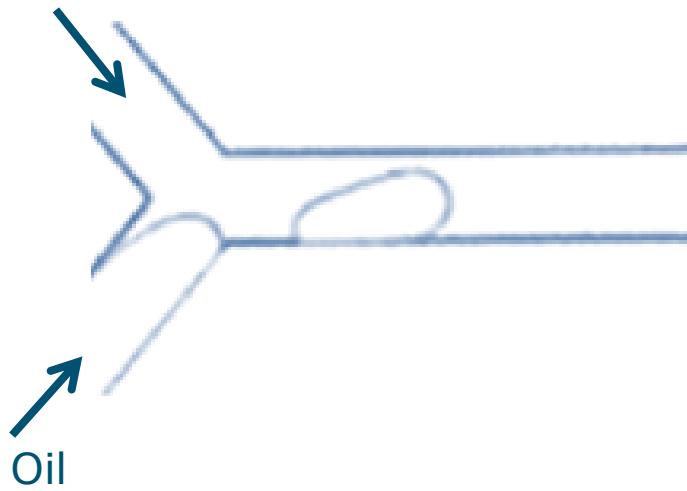
Continuous phase	η_c (mPa s) 20 °C	$\gamma_{hexadecane}$ (mN/m) 20 °C
Water	1.0	46
9% ethanol	1.5	27
28% ethanol	2.5	15
20% glycerol	1.8	37
30% glycerol	2.6	35
20 % sucrose	2.1	47
25 % sucrose	2.4	47

Dynamic interfacial tension

$$V = \frac{V_{ref}}{\sqrt{\frac{\eta_c v_c}{\gamma}}} + \frac{c}{v_c} \varphi_d \quad \longrightarrow \quad \gamma = \eta_c v_c \left(\frac{V - \frac{c}{v_c} \varphi_d}{V_{ref}} \right)^2$$

Dynamic interfacial tension measurement

0.01-0.5 wt. % sodium dodecyl sulphate (SDS)



Measure with image analysis

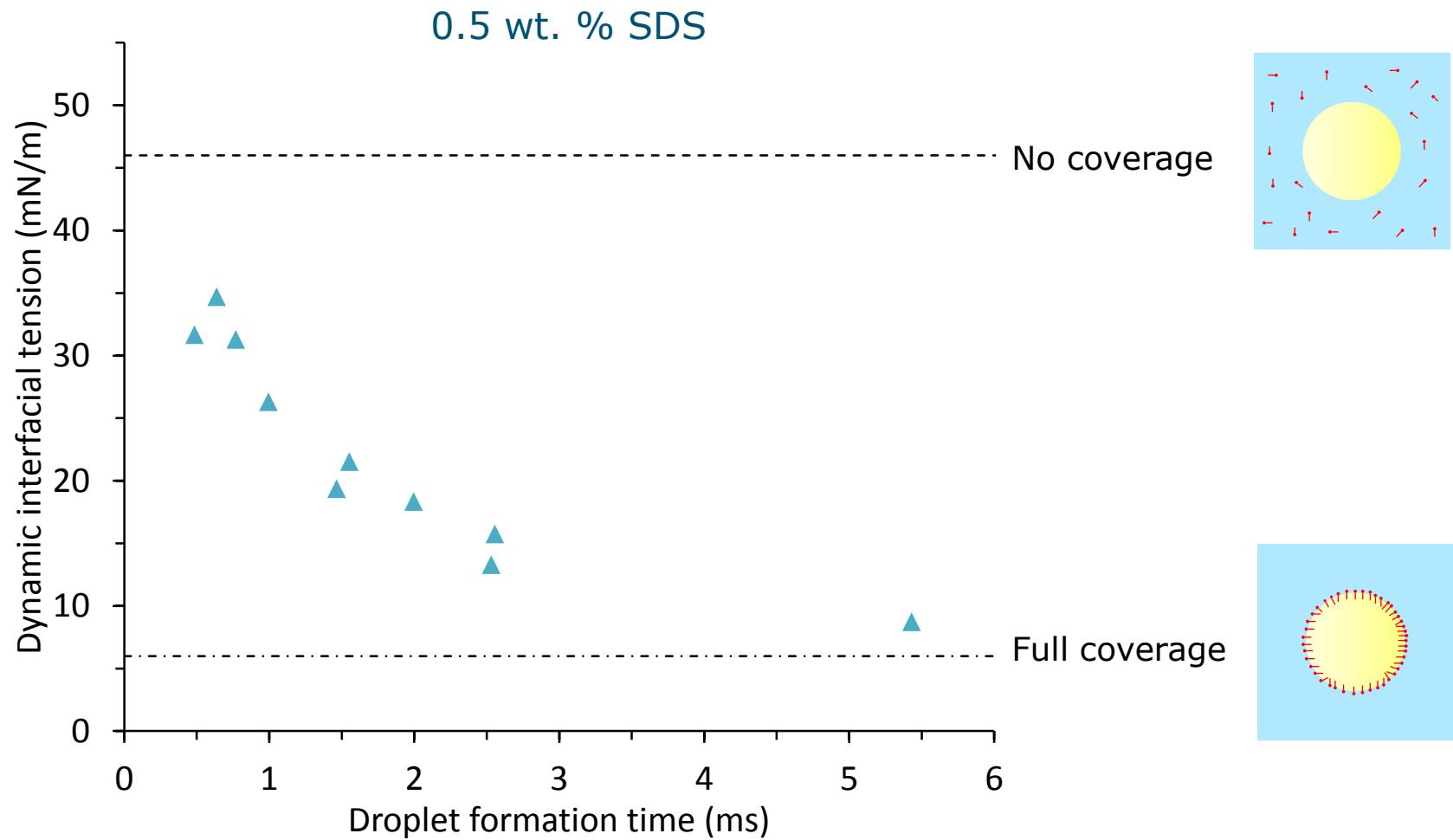
- Droplet size (V)
- Disperse phase flow rate (φ_d)
- Continuous phase velocity (v_c)



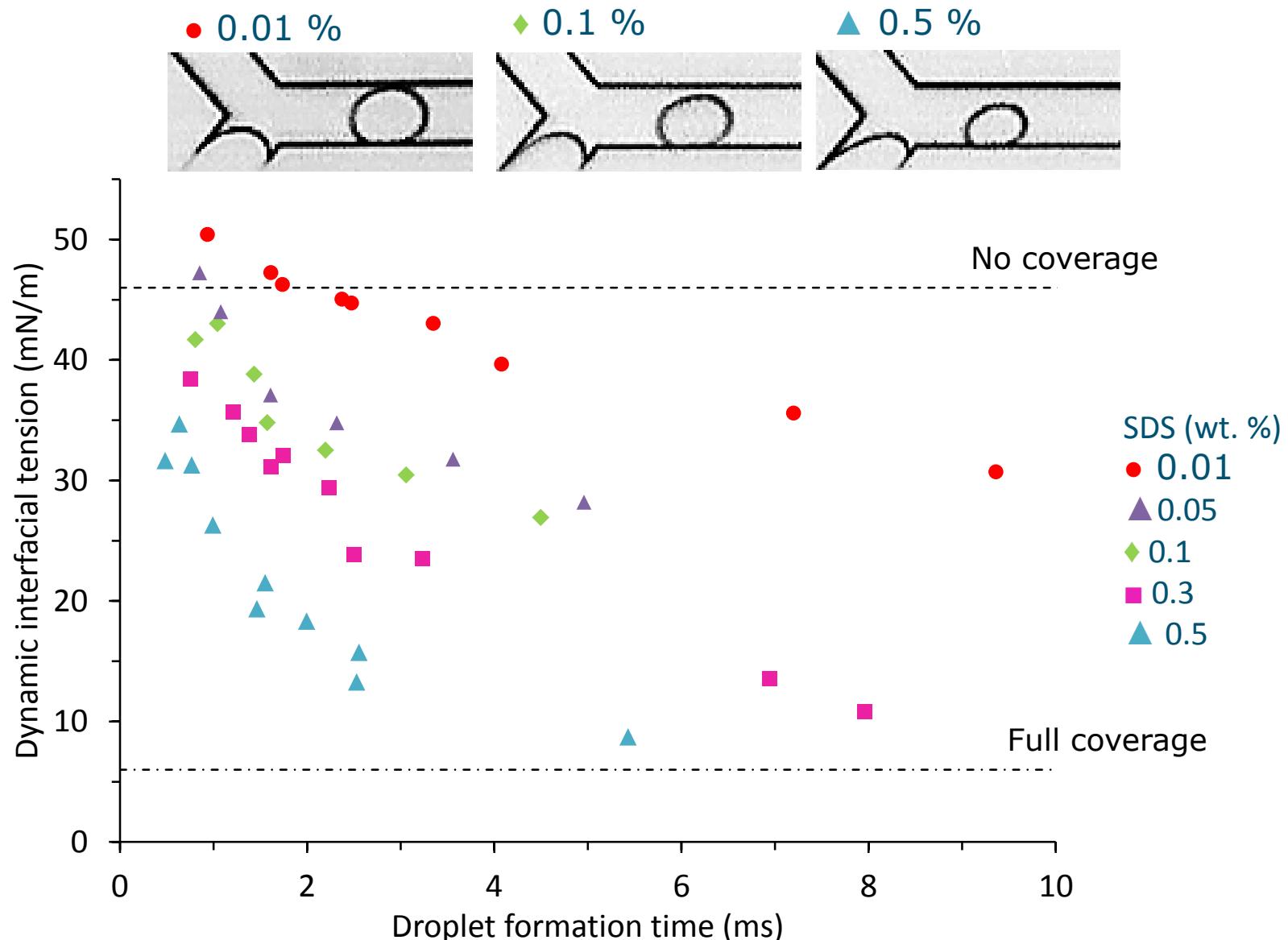
Calculate the dynamic interfacial tension

$$\gamma_d = \eta_c v_c \left(\frac{V - \frac{c}{v_c} \varphi_d}{V_{ref}} \right)^2$$

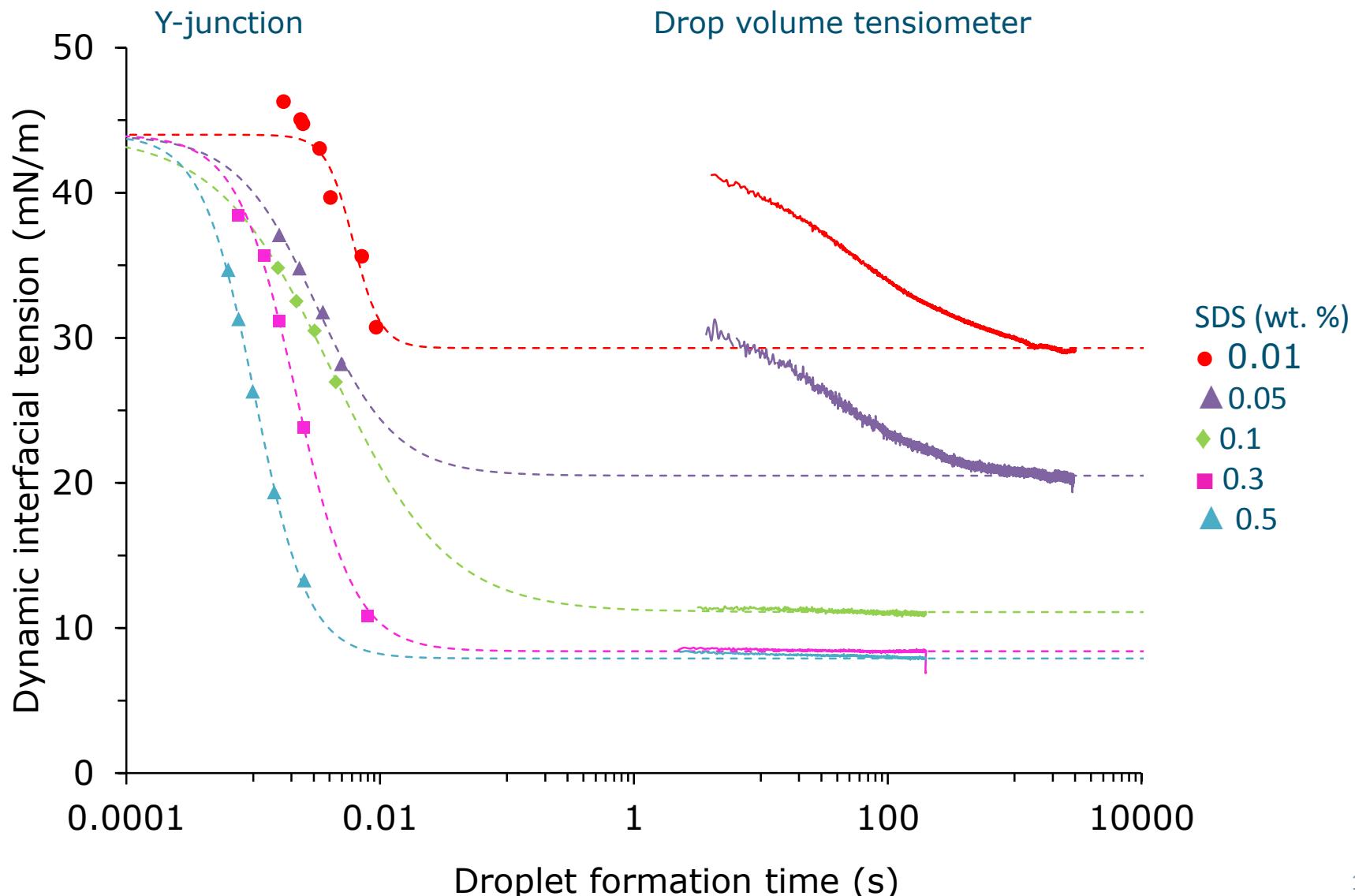
Sub-millisecond to millisecond measurements



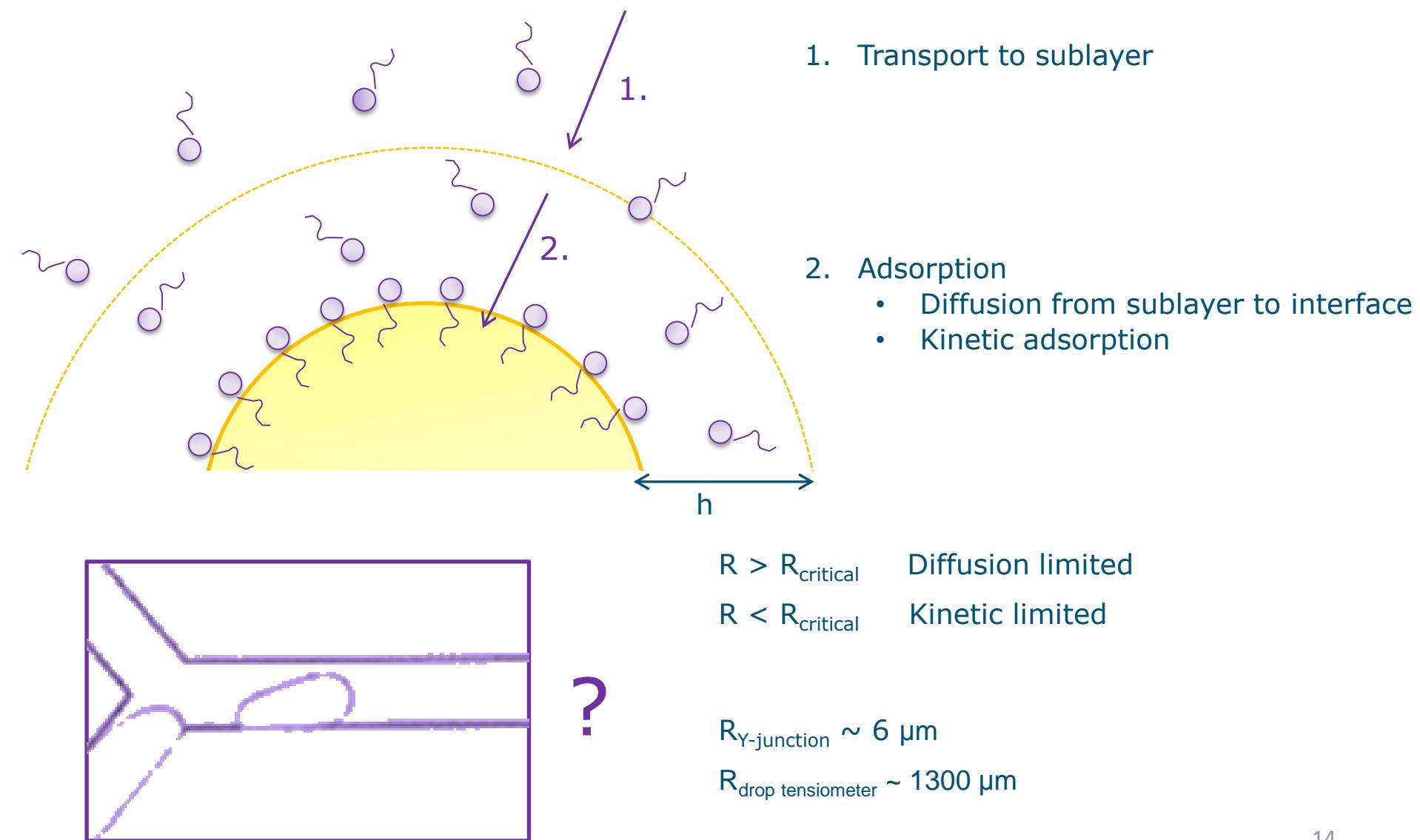
Dynamic interfacial tension: SDS



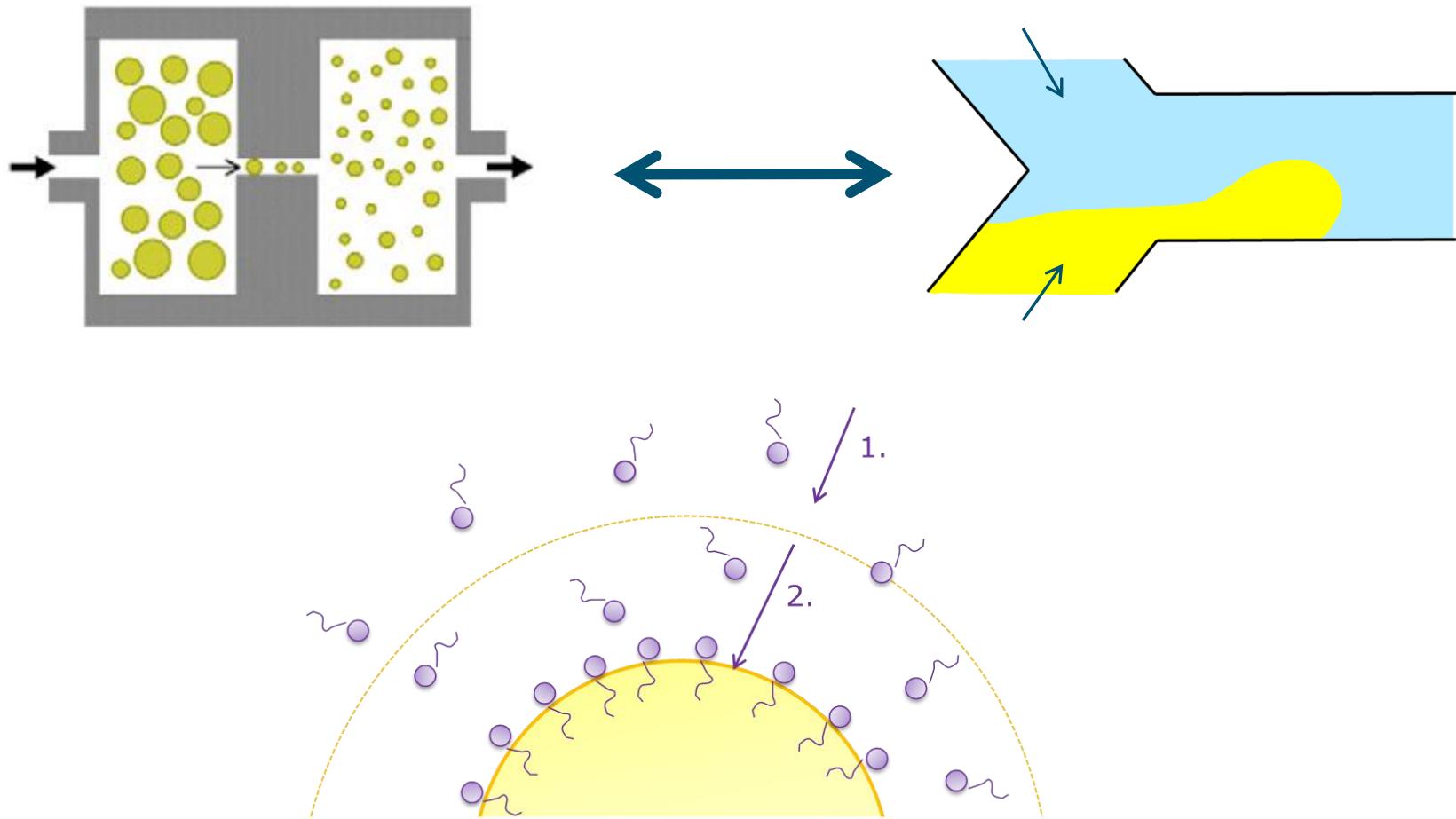
Adsorption dynamics



Adsorption dynamics



Conclusion



Thank you for your attention



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Matlab Script

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