UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Dipartimento
di Fisica
e Astronomia
Galileo Galilei

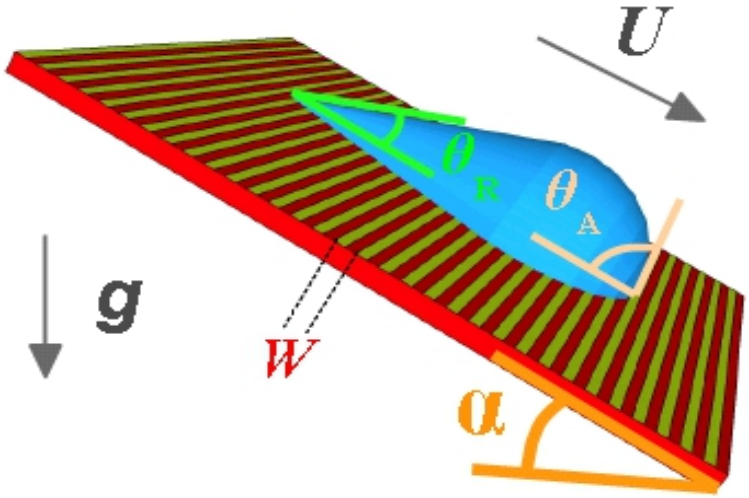
Sliding drops of water and of non-newtonian fluids

Silvia Varagnolo

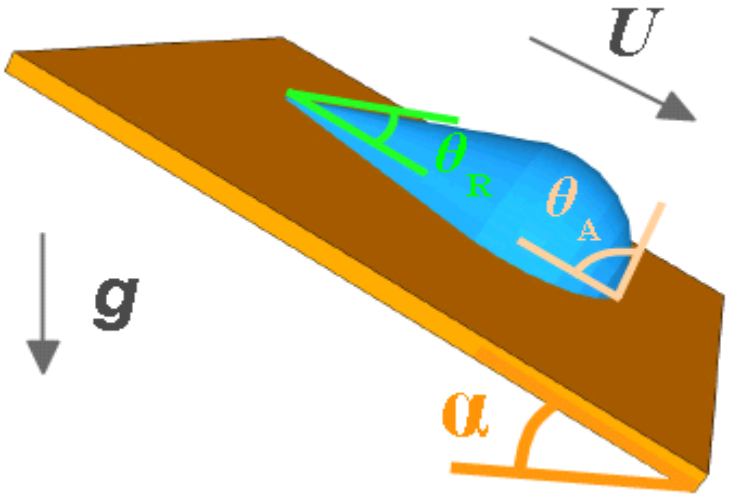
Flomat 2015, Rome, 26/3/2015

Experimental studies

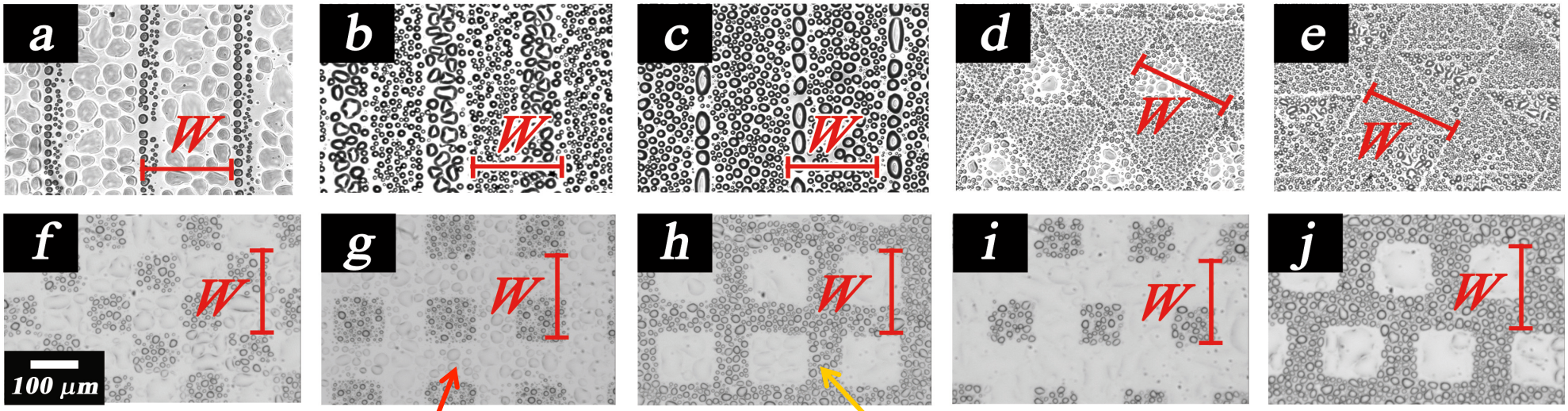
water



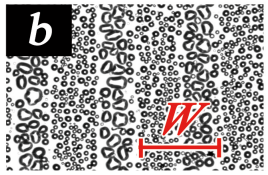
non-newtonian solutions



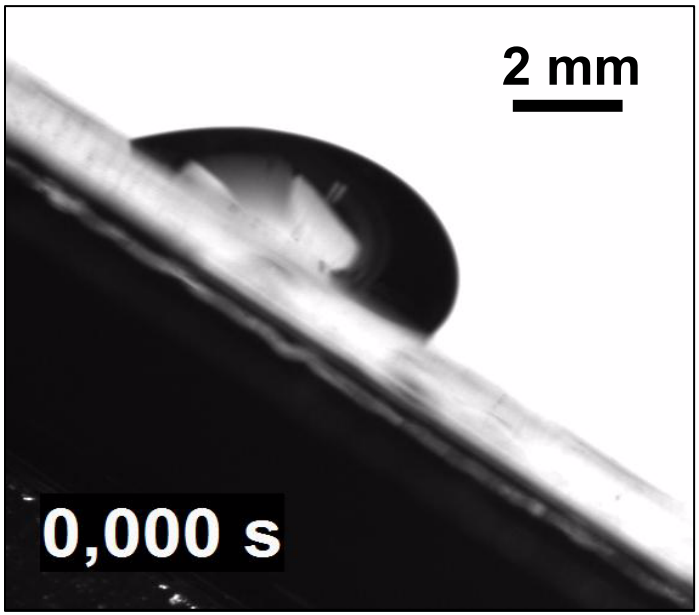
Chemically patterned surfaces

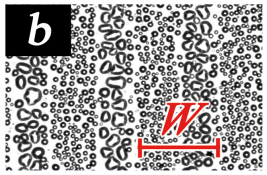


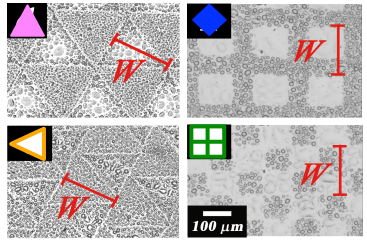
Stick-Slip on patterned surfaces

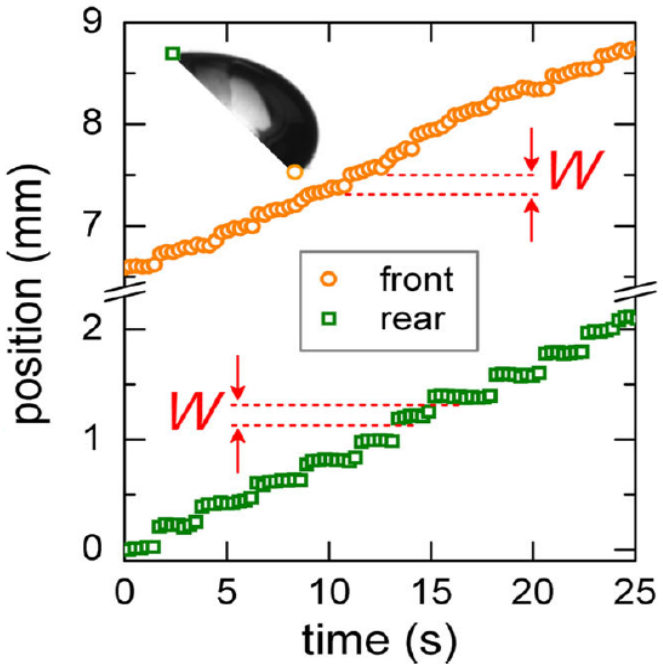


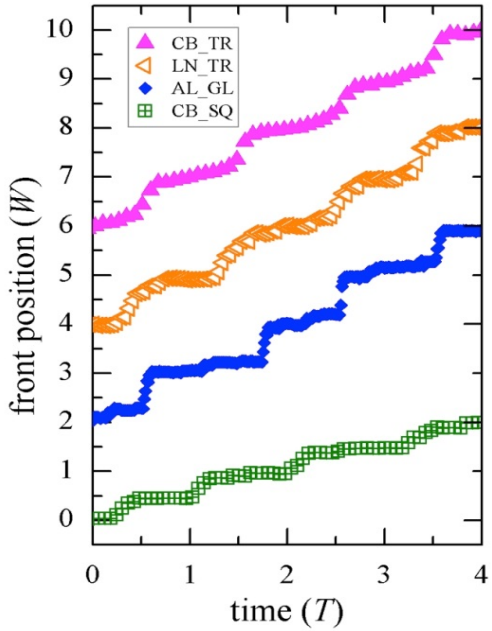
W = 200 µm





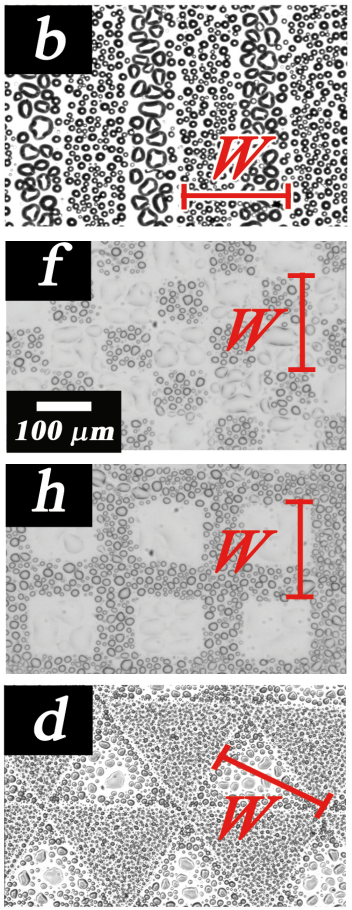




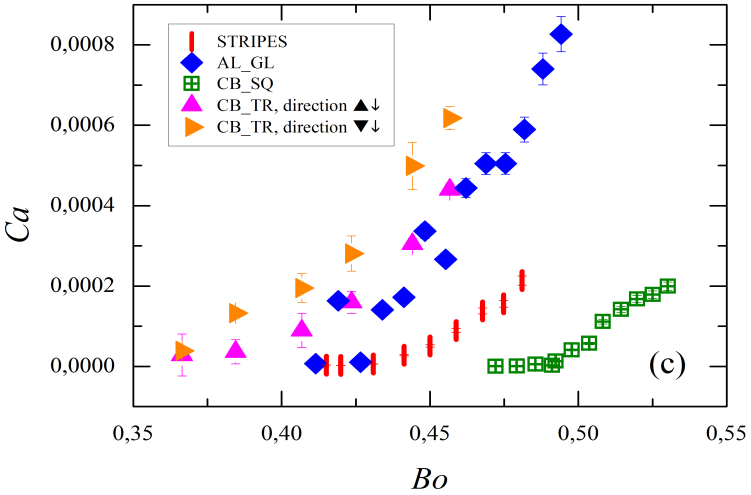


Varagnolo S. et al. *Phys. Rev. Lett* . 111, 066101 (2013)
Varagnolo S. et al. *Langmuir.* 30, 2401−2409 (2014)

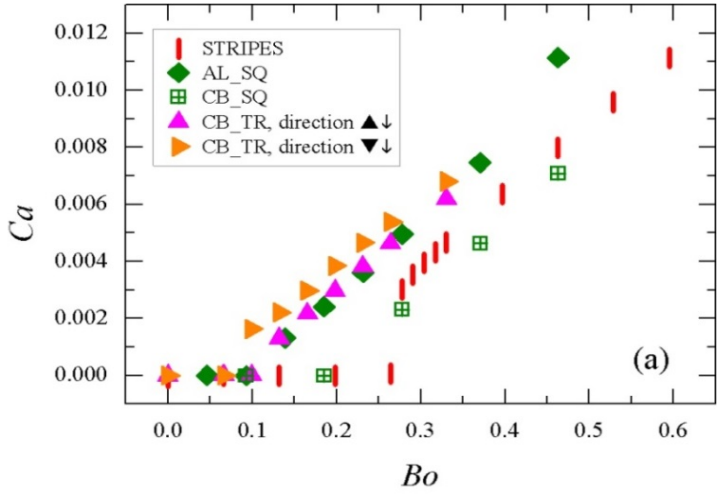
Stick-Slip on patterned surfaces



Experiment



LB Simulations



$$Ca = \frac{viscous\ forces}{surface\ tension} = \frac{\eta U}{\gamma}$$ Capillary number

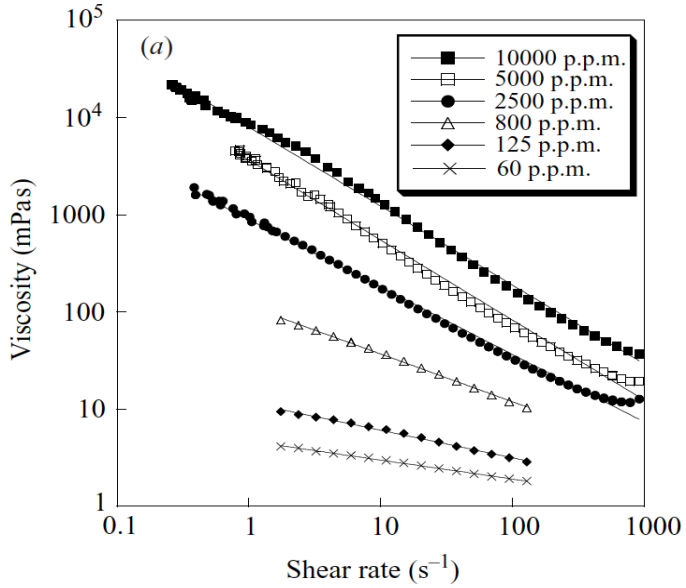
$$Bo = \frac{gravity}{surface\ tension} = \left(\frac{3V}{4\pi}\right)^{2/3} \frac{\rho g}{\gamma} \sin\alpha$$ Bond number

Varagnolo S. et al. *Langmuir.* 30, 2401−2409 (2014)

Non-newtonian solutions

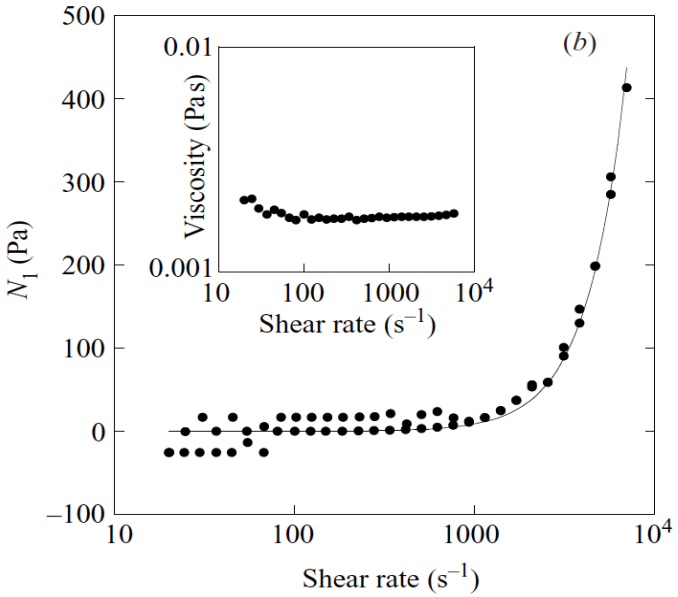
Xanthan

stiff rodlike polysaccaride



Polyacrylamide

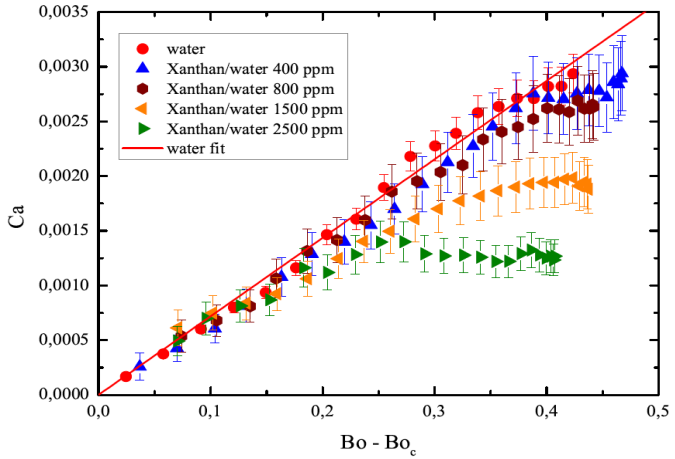
flexible polymer



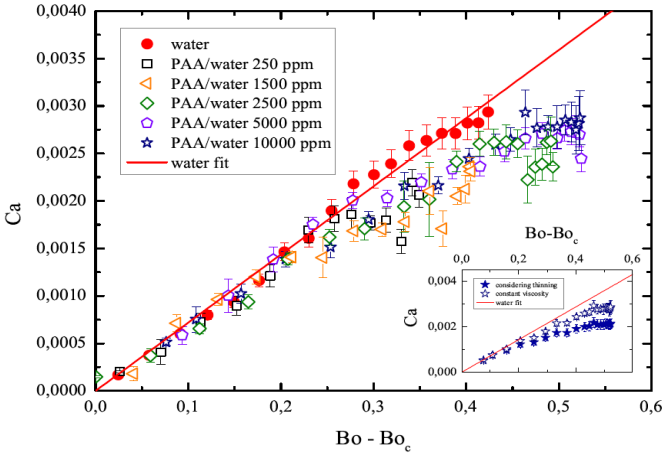
Rafaï et al., J. Fluid Mech. 513, 77-85 (2004)

Non-newtonian solutions

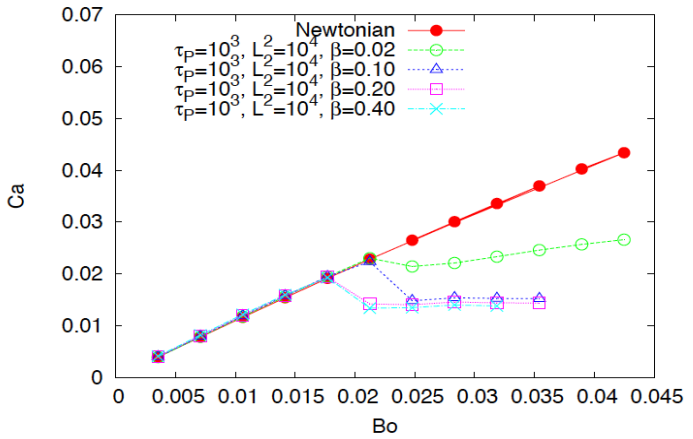
Xanthan



Polyacrylamide



LB Simulations



$$Ca = \frac{viscous\ forces}{surface\ tension} = \frac{\eta U}{\gamma}$$ Capillary number

$$Bo = \frac{gravity}{surface\ tension} = \left(\frac{3V}{4\pi}\right)^{2/3} \frac{\rho g}{\gamma} \sin\alpha$$ Bond number

$$Bo_c = \left(\frac{3V}{4\pi}\right)^{2/3} \frac{\rho g}{\gamma} \sin\alpha_c$$ Constant related to wettability

Suspension of non interacting finite extensible nonlinear elastic dumbbells

Viscoelastic fluid with normal stress difference effects

Conclusions

Chemical patterns:

- Stick-slip
- Controlling drop velocity

Non-newtonian solutions:

- Saturation of the velocity

UNIVERSITÀ DEGLI STUDI DI PADOVA

Acknowledgements

- **LaFSI**
- **Prof. Mauro Sbragaglia's group**
- **PhD School in Material Science and Engeneering**