Abstract Submitted
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Non-Newtonian fluid flow over a heterogeneously slippery surface[1] A. SANDER HAASE, JEFFERY A. WOOD, LISETTE M.J. SPRAKEL, ROB G.H. LAMMERTINK, Soft matter, Fluidics and Interfaces, University of Twente — The no-slip boundary condition does not always hold. In the past, we have investigated the influence of effective wall slip on interfacial transport for a bubble mattress – a superhydrophobic surface consisting of an array of transverse gas-filled grooves. We proved experimentally that the amount of effective wall slip depends on the bubble protrusion angle and the surface porosity (Karatay et al., PNAS 110, 2013), and predicted that mass transport can be enhanced significantly (Haase et al., Soft Matter 9, 2013). Both studies involve the flow of water. In practise, however, many liquids encountered are non-Newtonian, like blood and polymer solutions. This raises some interesting questions. How does interfacial transport depend on the rheological properties of the liquid? Does the time-scale of the experiment matter? A bubble mattress is a suitable platform to investigate this, due to local variations in shear rate. We predict that for shear-thinning liquids, compared to water, the amount of wall slip can be enhanced considerably, although this depends on the applied flow rate. Experiments are performed to proof this behaviour. Simulations are used to assess what will happen when the characteristic time-scale of the system matches the relaxation time of the visco-elastic liquid.

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