Two-dimensional glass transition of Janus particle-laden interface

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The behavior of Janus particles (JPs) populating interfaces is a growing field of research.[1] The enhancement in interfacial binding energy, in comparison to homogenous particles, and the dual characteristic of JPs open up new possibilities for novel applications.[2] In many such applications, interfacial materials become subjected to flows that produce dilational and shear stresses. Therefore, it is important to understand the impact that the Janus character brings to interfaces, specifically through complex capillary interactions.

In this work, we study the microstructure of two-dimensional (2D) JP monolayers formed at the air-water interface and examine the shear viscoelasticity with an interface rheometer that was adapted for in situ surface pressure control via a Langmuir trough.[3] We extend concepts from bulk rheology to interfacial rheology as a tool to understand the monolayer's viscoelastic behavior.[4] Finally, we conclude that a two-dimensional glass transition is taking place by calculating the time relaxation spectrum from the measured 2D dynamic moduli.[5]

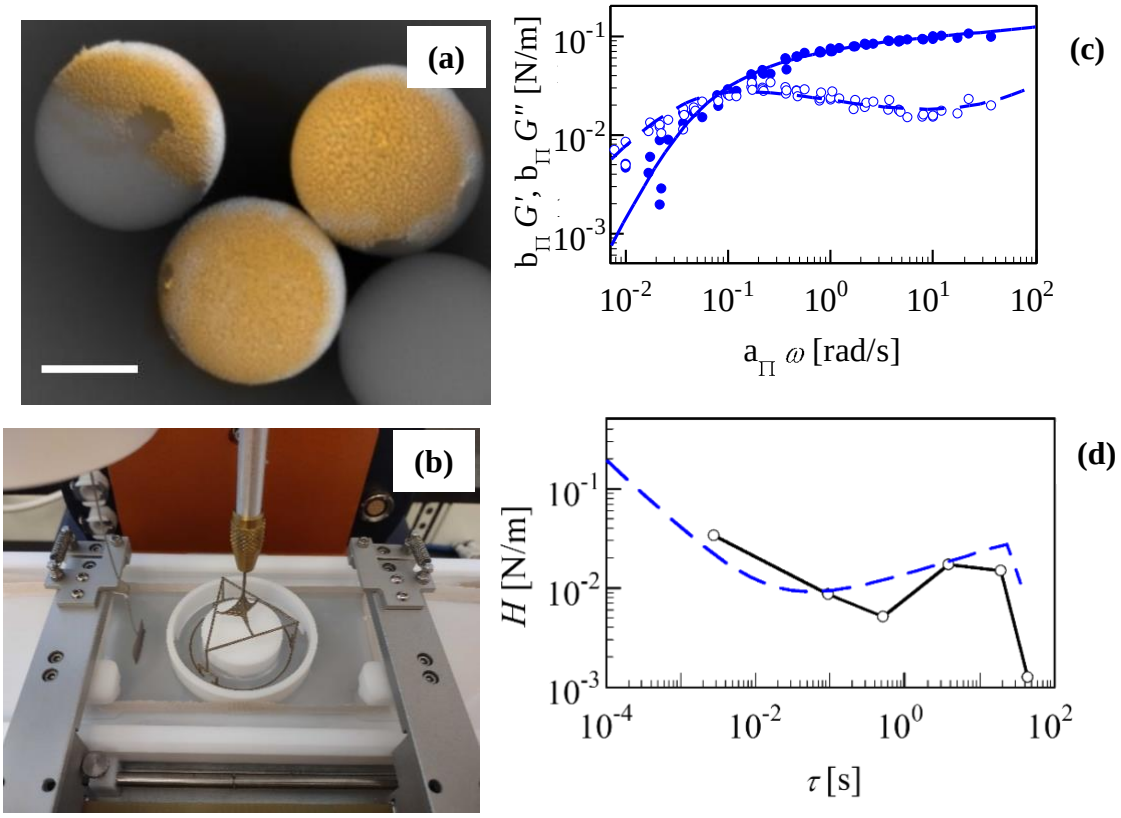

Figure: (a) Scanning Electron Microscope image of Janus particles with gold caps identified by the energy dispersive X-ray spectroscopy analysis and colored in yellow. Scale bar is 500 nm. (b) DWR geometry mounted in a Langmuir ribbon trough used to measure the shear rheology of Janus particle monolayers at the air-water interface. (c) 2D Dynamic modulus data merged onto a reference surface pressure of 30 mN/m; $b_\Pi G'(\omega)$ closed symbols, $b_\Pi G''(\omega)$ open symbols. (d) relaxation time spectrum H(τ). The rheological data were analyzed and plotted with the IRIS software.[7]

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