Onset of flow in a confined colloidal glass

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Understanding the mechanisms that build up flow in soft glassy systems remains an outstanding problem. In recent times, because of various practical applications, flow of such systems under confinement has also drawn considerable attention. Motivated by some recent experiments in gels [1] and colloids [2], we use numerical simulations to study the onset of flow, under confinement, in a model colloidal glass under externally applied stress. Typically, amorphous systems yield when the stress exceeds a threshold value (the yield stress) - we show that, in agreement with the experimental observations, the time-scales for the onset of steady state flow rapidly increase as the applied stress is lowered towards the threshold, along with the appearance of creeping regimes near yielding. Moreover we observe that, in confinement, these time-scales depend on the nature of the imposed stress - e.g, they are longer for a Poiseuille flow, compared to a Couette flow. We further elucidate the local mechanisms that lead to such observations.

[1] Thibaut Divoux, Catherine Barentin and Sébastien Manneville, Soft Matter, 7, 8409 (2011).
[2] M. Siebenbürger, M. Ballauff, and Th. Voigtmann, Phys. Rev. Lett. 108, 255701 (2012)