Abstract Submitted
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Free-volume anomaly in confined glycerol. DUNCAN KILBURN, Indiana University Cyclotron Facility, VICTORIA GARCIA-SAKAI, NIST Center for Neutron Research and University of Maryland, ASHRAF ALAM, Bristol University, PAUL SOKOL, Indiana University Cyclotron Facility — Glycerol is a small molecule glass-former which exhibits relatively high viscosity due to its extensive hydrogen bonding. Here we report the first measurements of local free volume and local mobility of glycerol confined in Vycor: a mesoporous silica glass with pores 70 Angstroms in diameter. We find that the lower molecular mobility in confinement (measured here using quasi-elastic neutron scattering) is accompanied by a higher mean free-volume size between molecules (as measured using positron annihilation lifetime spectroscopy). The strong wetting between glycerol and the glass surface appears to perturb the glycerol to such an extent that the normally observed free-volume/mobility relationship is reversed. Previous studies have come to similar conclusions (high glass transition temperature, low density) but this is the first to show that these effects originate locally. This is expected to have significant ramifications for the study of hydrogen-bonding liquids in confinement, for example water – a topic of much current interest due to its application in hydration water in biological material.

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