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Single Molecule Approaches to Studying Heterogeneity in Molecular Supercooled Liquids

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Supercooled liquids display behaviors consistent with the presence of heterogeneous dynamics. We investigate the length scales over which such heterogeneities exist and the time scales over which they persist using single molecule (SM) fluorescence microscopy. In previous work, multiple perylene diimide (PDI) probes were employed to investigate whether probe properties affected breadth of heterogeneity reported in the fragile supercooled liquid ortho-terphenyl (OTP) as well as in less fragile supercooled glycerol. In both cases, the fastest rotating probes reported the greatest breadth of heterogeneity in the host, regardless of physical probe size, suggesting slow probes were averaging over dynamic changes in the environment in time. Here, we introduce a new set of BODIPY-core based probes that are both smaller and more quickly rotating in OTP than the PDI probes. These probes show qualitatively different behavior than the PDI probes, reporting more spatial and temporal heterogeneity than previously studied probes. The newly employed probes open the door to studying the full range of consequences of dynamic heterogeneity in supercooled liquids on the molecular length scale.