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Dendronized polymer is a Single Molecule Glass JAYAJIT DAS, Dept. of Chemical Engr., UC Berkeley, YOSHIDA MASARU, ZACHARY FRESCO, TAE-LIM CHOI, JEAN FRECHET, Dept. of Chemistry, UC Berkeley, ARUP CHAKRABORTY, Dept. of Chemical Engr., UC Berkeley — The molecular architecture of dendronized polymers can be tuned to obtain nanoscale objects with desired properties. In this work, we bring together experiments and computer simulations to study the thermodynamic and dynamic properties of a single dendronized polymer chain. We find that, upon changing certain architectural features, dynamic correlations characterizing backbone conformational fluctuations of a dendronized polymer exhibit dynamical arrest akin to glass-forming bulk liquids. Thus, a dendronized polymer chain is a novel macromolecule that is a single molecule glass. The range of conditions that leads to dynamic arrest does not, however, correspond to any thermodynamic singularities. Therefore, a dendronized polymer provides the first example of an experimental system that can directly test theories of constrained dynamics. We also show that defect densities characteristic of typical synthesis conditions do not alter the material properties of dendronized polymers. The self-assembly of the chains studied using the results of the single chain yields different phases from lamellar to gyroid phases and nematic phases depending the relative volume fractions of the backbone and the dendron units and the flexibility of the backbone.

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