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Nanoscale physical properties of polymer glasses formed by solvent-assisted laser deposition KIMBERLY SHEPARD, CRAIG ARNOLD, RODNEY PRIESTLEY, Princeton University — High-energy, low-density nanostructured polymer glasses are formed via the solvent-assisted laser deposition technique MAPLE (Matrix Assisted Pulsed Laser Evaporation). During film deposition, micro- to nano-size polymer/solvent clusters are ejected via laser ablation from a frozen dilute polymer solution. During flight to the substrate under vacuum, the clusters experience rapid cooling and solvent stripping, forming polymer nanoglobules. Bulk polymer films are formed via the gradual assembly of these spherical-like nanostructured building blocks (i.e. nanoglobules). The MAPLE process thus enables investigation of the exceptional properties of glasses formed under extreme processing conditions. In the bulk state, we probe the effect of process parameters and chemical identity of the thermal behavior of a series of methacrylate polymers. We also employ multiple techniques to directly measure the properties of the polymer nanoglobules and connect the results to the global film properties. This talk will address nanoscale dilatometry via AFM, in which the volume of an individual polymer nanoglobule is tracked as it is heated through its glass transition, as well as Flash DSC analysis of the thermal properties of nanogram size MAPLE-deposited polymer glasses. We then discuss these findings in the context of the material's unconventional route to the glassy state.

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