Nano structuring Molecular Glasses via Anomalous Melting and Wrinkle Formation

(Calibri 15)

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When small organic molecules are deposited from vapor under optimized conditions, they can form thin film glasses with exceptional properties. These materials, known as ultrastable glasses (UG), exhibit enhanced stability and melt at temperatures well above the glass transition temperature (T_g) of the ordinary glass [1]. Thin film UGs transition into liquid through a surface-initiated growth front. If the surface is adequately capped by higher T_g material, melting occurs through a heterogeneous process that resembles nucleation and growth. This characteristic enables the creation of glasses with nanoscale regions that have varying stabilities and glass transition temperatures. We have extensively explored this anomalous transformation by nanocalorimetry [2,3] and real-time AFM imaging [4]. Additionally, molecular orientation can be tuned during growth, offering a way to control polarization in glasses containing dipolar molecules [1,5]. These combined properties open possibilities for improving organic light-emitting devices [6], enhancing bulk heterojunction photovoltaic cells or designing new nanostructures with unique functionalities. I will also discuss strategies and initial efforts to induce localized wrinkling in thin film ultrastable glasses, as well as the development of a nanostructured glass.

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