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# (G) Elastic Modulus of Stable Polystyrene Glasses

*Monday 27 May 2024 16:45 (15 minutes)*

We are studying stable polystyrene (PS) glasses prepared by PVD (physical vapour deposition) with N up to ˜12. These glasses have fictive temperatures as low as Tg -20 K with respect to its supercooled liquid line, and a kinetic stability of down to deposition temperatures of ˜ 0.84*Tg. Employing increased surface dynamics, vapour deposition can yield an effectively packed amorphous material in a layer-by-layer pattern. In our lab, recently we have started determining the elastic modulus of PS films via atomic force microscopy (AFM). We examined the elastic modulus of PS, with a film thickness of ˜ 100 nm, as a function of Mn (i.e., 11,200, 60,000 and 214,000 kg/mol), if the molecular size impacts the mechanical properties of the PS films. We observed a decrease in the magnitude of elastic modulus for PS as moving down to lower Mn. We also studied PS film with Mn = 214,000 kg/mol as a function of annealing time, annealed at the temperature of Tg + 20 K. The non-destructive nature of AFM allows us to determine the moduli of as-deposited glass, the supercooled liquid, and ordinary glass from a single sample. We will explore the mechanical properties of stable polymer vapour-deposited glasses of PS as a function of stability (down to Tg –20 K) and the film thickness (50 nm – 200 nm). We expect to observe an increase in the elastic modulus (i.e., 20 - 30%) of the stable polymer vapour deposited glasses of PS compared to the ordinary glass of PS with the same N.

## Keyword-1

Polystyrene Stable Glasses

## Keyword-2

Youngs' Modulus

## Keyword-3

polymer

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