



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 4408      Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

## (G) Elastic Modulus of Stable Polystyrene Glasses

*Monday, May 27, 2024 4:45 PM (15 minutes)*

We are studying stable polystyrene (PS) glasses prepared by PVD (physical vapour deposition) with  $N$  up to  $\sim 12$ . These glasses have fictive temperatures as low as  $T_g - 20$  K with respect to its supercooled liquid line, and a kinetic stability of down to deposition temperatures of  $\sim 0.84^*T_g$ . 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  $\sim 100$  nm, as a function of  $M_n$  (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  $M_n$ . We also studied PS film with  $M_n = 214,000$  kg/mol as a function of annealing time, annealed at the temperature of  $T_g + 20$  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  $T_g - 20$  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

**Author:** Ms MEHMOOD, Mahnoor (University of Waterloo, ON, Canada)

**Presenter:** Ms MEHMOOD, Mahnoor (University of Waterloo, ON, Canada)

**Session Classification:** (DCMMP) M3-6 Soft Condensed Matter III | Matière condensée molle III (DPMCM)

**Track Classification:** Technical Sessions / Sessions techniques: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)