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The glass transition temperature of thin polycarbonate films and trinitrotoluene (TNT): Measured by Flash Differential Scanning Calorimetry (Flash DSC)

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Flash differential scanning calorimetry was used to study the glass transition temperature of polycarbonate thin films over a range of 22 – 350 nm. The investigation was made as a function of film thickness and cooling rate ranging from 0.1-1000 K/s. The results for polycarbonate thin films show a greatly reduced glass temperature relative to that of the macroscopic value. We also observed that, the magnitude of ΔT_g decreases as the cooling rate increases. The obtained data have been compared with the literature results for supported and freely standing PC films and the results are more similar to what is observed for films supported on rigid substrates than for freely standing films. Similarly, Flash Differential Scanning Calorimetry (Flash DSC) has also been used to determine the glass transition response of the rapidly crystallizing material, TNT. After heating at 600 K/s, it was found that for cooling rates from 1000 K/s to 10 K/s the glass transition changes from 247.5 K to 239.3 K. The dynamic fragility index was determined to be $m = 62 \pm 6$ and the activation energy determined from the range of cooling rates in which vitrification occurred was found to be 290 ± 16 kJ/mol. Crystallization was found to occur during cooling rates below 0.3 K/s, whereas cold crystallization was found on subsequent heating after cooling between 10 K/s and 30 K/s. At cooling rates of 100 K/s and above, and for the same heating rate of 600 K/s was investigated. The glass transition event was observed, but cold crystallization during heating did not occur. Hence, the crystallization behavior of the fully amorphous TNT upon heating depends on the cooling rate and vitrification path.

Biography

Nabila Shamim has completed her BS from Bangladesh University of Engineering and Technology, Bangladesh and PhD from National University of Singapore. She did a Post-doctoral Fellowship from Texas Tech University, USA. She is actively involved in Polymer Science research and has published more than 15 peer reviewed and conference papers. She is currently working as a Faculty at Prairie View A & M University, USA. Her research focuses on characterization and application of nanomaterials and thermal properties of polymeric materials.

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