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Anomalous relaxation mechanism for rejuvenation of stable polystyrene glass

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We report on the rejuvenation of thin films of polystyrene (PS) as they are heated from stable glassy states - prepared either through vapour deposition or physical aging. For films with thickness $h \approx 150$ nm and less than $h \approx 100$ nm the rejuvenation of vapour deposited stable PS glass films follow behaviour well-documented for other stable glasses. This behaviour is quantitatively described by simulations using parameters previously obtained from isothermal rejuvenation measurements in the same material. For films with thickness $h \sim 140$ nm the behaviour of the vapour deposited films becomes more complicated, and exhibits significant deviations from model predictions. The results are compared with vapour deposited films that are aged after rejuvenation. Collectively, the results of these studies suggest a new distinct mechanism that can result in the rejuvenation of glassy PS, and hence two distinct relaxation processes that can couple to the material density.

Keyword-1

Stable Polymer Glasses

Keyword-2

Relaxation processes

Keyword-3

Rejuvenation

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