Entropy diluent in polymer crystals and blends

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Over the pase century, significant progress has been made in understanding the properties of polymers and this progress has been driven by innovative synthetic techniques, precise experimentation, and profound physical insight. However, despite the widespread approaches with enthalpic perspective, such as tailoring chemical structures and controlling molecular interactions, there has been little active effort to exploit polymer properties by manipulating entropy.

In this presentation, we will explore the role and importance of entropy control in various studies of polymer properties, such as crystallization, blending, and phase transition with the case of the novel concept named “entropy diluent” substantially decrease the conformation entropy of polymer chains. For example, atatactic poly(methyl methacrylate) (PMMA) was successfully crystallized into 1D hypo-crystals whose polymer chains are laterally oriented and closely packed in one direction perpenticular to the molecular axis. Also, straightforward prepartion method suppressing phase separation of incompatible polymer blends, such as polystyrene (PS)/PMMA, to the level of indistinguishable dynamic heterogeneity.

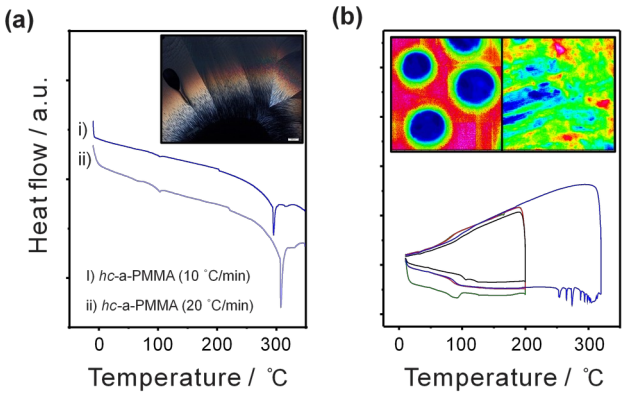

Figure 1. DSC thermograms of (a) 1D hc-PMMA and (b) PS/PMMA$_{BA}$: inset in panel (a) shows polarized optical microscopy image of 1D hc-PMMA film and in panel (b) represents polarized FT-IR mapping images of PS/PMMA (left image) and PS/PMMA$_{BA}$ (right image).

Keywords: entropy diluent, 1D hypo-crystals, polymer blends

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References

[1] Sim, J. H.; Kwon, Y.; Eom, S.; Hwang, M.; Park, S.; Choi, H.; Chung, H.; Sohn, D.; Kang, Y. 1D Hypo-Crystals of Stereo-Irregular PMMA via Spray-Induced Rapid Solidification of Aqueous Solutions. *Macromolecules* **2022**, *55*, 1700-1708.

[2] Sim, J. H.; Eom, S.; Lee, S.; Oh, C.; Lee, M.; Kim, S.; Lee, W. B.; Ryu, J.; Sohn, D.; Chung, H.; Hyon, J.; Park, C.; Thomas, E. L.; Kang, Y. 1D hypo-crystals: A novel concept for the crystallization of stereo-irregular polymers. *Materials Today.* **2020**, *40*, 26-37.