A New Perspective for Nanoconfined Crystals

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Nanoconfined crystals are commonly found in nature and play a crucial role in various biological activities such as intracellular freezing and protein crystallization. It is important to understand how confinement affects crystallization in many fields, including nanotribology (which deals with lubrication, adhesion, and wear) and the development of nano-engineered organic electronics within [1]. The process of crystallization starts with nucleation, which determines the structure, quantity, and size distribution of the crystals. Nucleation is essentially a nanoscale process of creating a new phase randomly. Therefore, studying nanoconfined systems can help us gain insights into the actual nature of nucleation.

Today, there is a clear consensus in the literature that the crystallization of semi-crystalline polymers in nanoconfinement is dominated by homogeneous nucleation within [2-4]. As a result, the melting and freezing temperatures are lowered compared to the bulk. The source of this effect is usually correlated with either the compartmentalization effect or the spatial confinement. The confining geometry (whether it's flat, cylindrical, or spherical) is also important since curvature affects Laplace pressure. In this context, we will discuss a detailed analysis of the impact of compartmentalization, space, curvature, interfacial interaction, and molecular weights on the nano-crystallization process.

References

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Figures

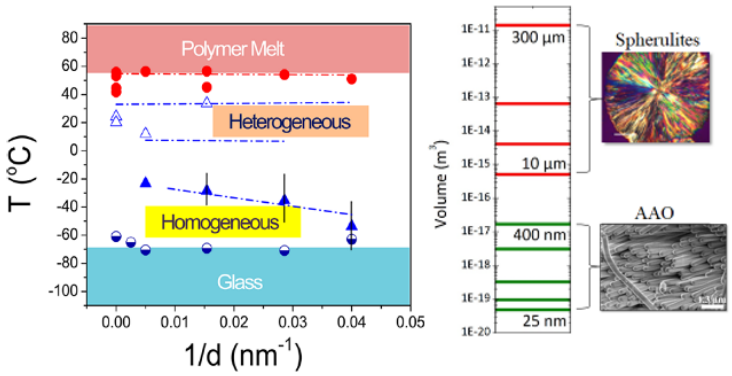

Figure 1: "Phase diagram" of PEO114-b-PCL88 in AAO [4].