Thermal Characterization of polysulfone nanoparticles: a study of glass transition and devitrification kinetics

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Amorphous polymer nanoparticles have become increasingly popular due to technological advancements in the modern era. In addition to their practical uses, the reduction in size of polymers has ignited fundamental inquiries into the underlying physicochemical processes that drive changes in properties at the nanoscale. Polymers that are confined at the nanoscale, due to factors such as size effects, interfacial effects, and spatial limitations, exhibit distinct thermodynamic properties compared to their bulk counterparts [1]. This is because the confinement affects the mobility of the polymer chains. A topic of particular debate is the modification of glassy dynamics in nanostructured polymeric glasses. The interest in this topic was stimulated by the observation of a decreased glass transition temperature (Tg) in thin polymer films during the early 1990s [2]. Since that time, a significant amount of research has been dedicated to studying the slow movement of particles in nanostructured polymers. The primary objective of this study was to analyse the thermal properties of poly(sulfone) (PSU) nanoparticles. Nanoparticles ranging in size from roughly 400 to 100 nm were produced using the nanoprecipitation method by changing the solvent and non-solvent nature. The accuracy of these findings was verified by a combined approach of dynamic light scattering (DLS) and scanning electron microscopy (SEM). The thermal behaviour was studied by differential scanning calorimetry (DSC) yielding insights into both the kinetics of devitrification and the segmental mobility of the nanoparticles.

References

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