

SAXS Study of Neodymium-Doped Poly(oxyethylene)/Siloxane Hybrids

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The structural features of two families of sol-gel derived poly(oxyethylene)/siloxane hybrids doped with neodymium triflate, $\text{Nd}(\text{CF}_3\text{SO}_3)_3$, were investigated by Small-Angle X-ray Scattering (SAXS). Their organic/inorganic matrix is a siliceous network to which short oligopolyether chains are covalently bonded to both ends by means of urea and urethane linkages, respectively. Transparent, flexible, monolithic xerogels with $\infty \geq n \geq 40$ (where n , so-called composition, represents the number of ether oxygen atoms per Nd^{3+} ion) were prepared. The SAXS patterns of the undoped di-ureasils exhibit a strong interference peak located at medium q -range which reveals the existence of a spatial correlation between the siloxane nanoclusters grafted to the polymer segments. The introduction of Nd^{3+} ions in such hybrids leads to the appearance in SAXS patterns of an additional scattered decreasing intensity at low q -range which reveals the existence of a two-level hierarchical structure: the primary level consists of small and spatially correlated siloxane nanoclusters and the secondary level corresponds to large domains, in which the siloxane clusters are located, surrounded by a depleted polymeric phase. A theoretical function was used to fit the experimental scattering curves and to determine the structural parameters corresponding to each level. The di-urethanesils hybrids exhibit quite different behavior since the two-level hierarchical structure already exists in the undoped sample. In both families, the increase of Nd^{3+} content leads to a decrease of the correlation peak intensity, suggesting that the cations interact mainly with the ether-type oxygen atoms of polymer chains. The determination of the structure of both type of composites allowed us to get a better understanding of their luminescent, ionic conduction and thermomechanical properties.