

Concentration fluctuations in a binary glass former investigated by x-ray photon correlation spectroscopy

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We investigate structure and dynamics of concentration fluctuations in the binary glass former methyl-tetrahydrofuran and oligomeric methyl metacrylate by photon correlation spectroscopy with partially coherent x-rays from a synchrotron source. Although the system is macroscopically well miscible and optically clear in the full temperature range, calorimetric and dielectric measurements reveal two distinct glass transition temperatures. The relaxation of long range concentration fluctuations turns out to be diffusive and exponential only well above the upper glass transition temperature. As the characteristic time τ_{cf} for concentration fluctuations shows a much weaker temperature dependence than the α -relaxation both traces finally intersect upon lowering the temperature. Thus, close to T_g , the concentration fluctuations show pronounced features of out-of-equilibrium dynamics such as compressed relaxation functions and a crossover to a ballistic wave vector dependence of τ_{cf} , like previously observed in various soft matter systems. Moreover, the analysis of time-resolved correlation functions reveals that the relaxation of concentration fluctuations around T_g involves pronounced dynamic heterogeneities.