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Dynamics in Miscible Blends: Recent Results and Open Questions

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The study of polymer blends has been a very active field in polymer physics during the past 20 years. However, many questions still remain open. From the point of view of the polymer blend dynamics, the so-called dynamic miscibility, i.e., the question concerning how the dynamics of each component is modified in the blend, has been deeply investigated. In an ideal two-component miscible polymer blend one could expect a completely homogeneous dynamic behavior, in the meaning that the time scale as well as the relaxation function of each component becomes similar in the blend. However, miscible polymer blends are in general dynamically heterogeneous. This heterogeneity manifests in two ways. On the one hand, when the segmental dynamics (alpha-relaxation) of a single component of a blend is selectively investigated, it is found that the response extends over a very broad time/frequency range, in particular in the vicinity of the glass transition temperature. On the other hand, distinctly different local segmental mobilities for the two blend components are observed even at temperatures well above the glass transition. Whether these two manifestations have the same microscopic origin or they put in evidence two different aspects of the polymer blend dynamics is still controversial. Two different but perhaps complementary concepts have been used to describe the above-described phenomenology: thermal concentration fluctuations and the so-called self-concentration. However, a complete theoretical description still remains elusive. The main goal of this talk is to present an overview of the current status on this topic. New results - not only from relaxation techniques but also from neutron scattering and molecular dynamics simulation as well - will be also presented and discussed.