Dynamic Heterogeneities in Amorphous Materials

R. BÖHMER

Fakultät für Physik, TU Dortmund, Germany

Dynamic heterogeneities are now recognized to play a vital role in amorphous materials including supercooled low-molecular weight liquids, molten polymers, and amorphous ion conductors, to name a few. These classes of substances share a number of quasi-universal behaviors with respect to the dominant dynamical process which accompanies their vitrification, the so called structural relaxation. Among the most salient features of this process are its super-Arrhenius and non-exponential characteristics. The existence of dynamical heterogeneities as a hallmark of the latter, i.e., the simultaneous presence of fast and slow components in the primary response, has long been debated controversially but can now be considered firmly established. This is due to the fact that this aspect of the complex relaxation pattern in disordered matter has been investigated by numerous methods, both from theoretical and from experimental perspectives.

In this contribution, we mainly review experimental activities in the field focusing on the temperature range close to the calorimetric glass transition at which primary as well as secondary relaxations are typically present. Results from methods such as nuclear magnetic resonance, optical probe spectroscopy, nonresonant hole burning and related dielectric techniques as well as other spatially and spectrally selective methods will be discussed and compared with each other.