

Non-ergodicity in Locally-ordered Systems in the Proximity of the Glass Transition

L. Comez, Università di Perugia (Italy)

In the field of structural arrest processes, the mode coupling theory (MCT) was introduced to provide a self-consistent scheme for the progressive slowdown of the molecular motion of systems approaching the glass transition. At the basis, a mechanism of particle caging was postulated. Practically, different mechanisms of caging may take part in glass formation. In simple liquids, the cage effect arises by packing constraints; conversely, in associated and in covalent liquids, the cage formation is controlled by constraints introduced by the formation of hydrogen or covalent bonds. Efforts have been made in a number of glass formers to test experimentally the predictions of MCT. In spite of the positive results for Van-der-Waals molecular liquids, the results for associated and covalent liquids are often mutually contradictory and not conclusive.

Different mode coupling predictions can now be tested through High resolution Inelastic X-ray experiments. In this respect, the IXS technique is an excellent probe to investigate heterogeneous systems with static features located at low Q-values (few nm^{-1}) in the static structure factor.

Our experimental results on m-toluidine demonstrate that the presence of local order can coexist with the signatures of the ergodic to non-ergodic transition predicted by MCT. These findings play in favour of a universal MCT picture and opens the way for the investigation of the fast dynamics of a wide class of clustering systems including network forming polymers, where the structural arrest is controlled by irreversible bond formation.