

Where Come from Dynamic Heterogeneity in Glass Transition? : Similarity with Liquid-Liquid Transition

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Where come from dynamic heterogeneity in glass-forming liquids? It is a long-standing problem for glass transition phenomena¹. In this presentation, we introduce our experimental study about slow dynamics and a heterogeneity (inhomogeneity) induced in liquid-liquid (l-l) transition, and discuss the relation between these two transitions.

Liquid Te and its mixtures with Se are famous systems to exhibit continuous l-l transition², whose similarity with liquid water is sometimes discussed^{3,4,5}. Se-Te also have a glass-forming ability. The density inhomogeneity in the system is tiny but surely exists and shows a peak at l-l transition, which is first proved by our small-angle x-ray scattering measurement⁴. About the dynamics, we deduce the relaxation intensity by sound velocity measurements⁵: The result shows that it varies in conjunction with the transition and also exhibits a peak at l-l transition. The relaxation time has not determined precisely, but at least is revealed to vary strongly with temperature and exceeds over 10^{-9} s; there appears a slow dynamics⁶.

These experimental results obtained for l-l transition recall the similarity to the dynamic heterogeneity in glass transition, and in fact reminds us of a bold idea that the origin of the two phenomena is same: Dynamical heterogeneity comes from the critical fluctuations of l-l transition, not from the nature of supercooling. Of course, there are not yet enough evidences for this scenario and it is thus a speculation at the present stage. But we believe that it is worth to be discussed because it can give a simple explanation to the fragility index of glass-forming liquids: How close is the state to the critical pressure of l-l transition⁷. We look forward to a frank discussion.

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