SEMINAIRE DE LA MATIERE CONDENSEE

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Cooperativity and Heterogeneities in Dynamics of Glass-Forming Systems: New Insight

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Salle de conférence 15 – Bâtiment 563

The mechanism behind the steep slowing down of molecular motions upon approaching the glass transition remains a great puzzle. Most of the theories relate this mechanism to the cooperativity in molecular motion. However, direct measurement of molecular cooperativity is currently not accessible and in many cases the length scale of dynamic heterogeneity is measured instead. In this talk we present estimates and analysis of the length scale of dynamic heterogeneity ξ in many glass-forming systems. We demonstrate that ξ directly correlates to the dependence of the structural relaxation on volume (density). This dependence presents only one part of the mechanism of slowing down the structural relaxation. Our analysis reveals that another part, the purely thermal variation of the structural relaxation, does not have a direct correlation with molecular heterogeneity. Moreover, detailed analysis reveals no correlation between the steepness of the temperature dependence of structural relaxation and the length of dynamic heterogeneity. This correlation is expected in most of the current models proposed for description of the glass transition. These results call for a conceptually new approach to the analysis of the mechanism of the glass transition and to the role of molecular coopertaivity/heterogeneity in slowing down of structural relaxation.

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