Segmental mobility at the glass transition in glass forming liquids : Comparison of two approaches.

Allisson Saiter[*1], Jorge Arturo Soto Puente[1], Bidur Rijal[2], Laurent Delbreilh[1], Kateryna Fatyeyeva[3], and Eric Dargent[1]

[1]Groupe de Physique des Matériaux (GPM) – Centre National de la Recherche Scientifique - CNRS – 76000 ROUEN, France

[2]Laboratoire de Chimie Moléculaire et Thio-organique (LCMT) – Centre National de la Recherche Scientifique - CNRS – France

[3]Polymeres Biopolymeres Surfaces (PBS) – Centre National de la Recherche Scientifique - CNRS – France

Abstract

This work investigates the cooperative molecular dynamics at the glass transition through two different theoretical approaches (the approach proposed by L. Berthier [1] and the extended Donth's approach [2,3]) for different glass-forming liquids in a wide range of frequency and temperature. The experimental investigation has been carried out by means of Modulated Temperature Differential Scanning Calorimetry (MT-DSC) and Broadband Dielectric Spectroscopy (BDS).

The first approach allows estimating Nc the number of dynamically correlated molecules during the main relaxation process, and the second one allows estimating Na the number of structural units in a Cooperative Rearranging Region (CRR). But, does it exist a clear difference between Nc and Na ?

In a first work concerning different fully amorphous polymers with different backbones, the molar mass of the relaxing units seemed having an impact on Nc and Na values, involving differences between these two quantities [4].

In a second work, our motivation was examining Nc and Na with time and temperature variations in amorphous copolymers of poly(ethylene-co-vinyl acetate) (EVA) with different vinyl acetate content (VAc): from PVAc (100 wt.% VAc) to EVA50 (50 wt.% VAc). This sample family presented the advantages to have the same backbone, practically the same molar mass, but different number of dipolar pending groups, i.e. different inter-chain dipolar interactions [5,6].

All these investigations will be presented through the presentation.

Donth, E. J. Non-Cryst. Solids 1982, 53 (3), 325–330.

Saiter, A. et al. Phys. Rev. E 2010, 81, 041805.

---

[*]Speaker

Berthier, L. et al. Science 2005, 310 (5755), 1797–1800.

Rijal, B. et al. Macromolecules 2015, 48, 8219–8231.

Puente, J. A. S. et al. Polymer 2015, 76, 213–219.

Rijal, B. Et al. Phys. Rev. E 2016, 94, 062502.

Keywords: Glass transition, Glass, forming liquids, Dynamic heterogeneity, Cooperative motions, Correlated motions.