EFFECT OF CONFINEMENT IN SEGREGATED BLOCK COPOLYMER ON THE POLYMER COMPONENTS MOLECULAR MOTIONS

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Block copolymers spontaneously self-assemble into well defined structures with variable geometry (spherical, cylindrical, lamellar etc) depending on the chemical details (molecular structure, composition etc) and external conditions such as temperature and pressure. This structure formation, typically in the range of some tenths to hundreds of nanometer, is useful to investigate how finite size effects influence the polymer chain dynamics.

For this purpose, poly(isoprene)-poly(dimethyl siloxane) block copolymer melts (PI-PDMS) are ideal as a model system as the both polymers exhibit a low glass transition temperature and a strong mutual repulsion ($\chi \sim 0.07$). Consequently PI-PDMS spontaneously self-assemble to well defined equilibrium structures. Most importantly in the context of dynamics, cis-PI exhibits a dipole both parallel and perpendicular to its backbone allowing a simultaneous observation of both the global normal mode relaxation (associated to the fluctuation of ten ed-end distance) as well as the local alpha relaxation (related to the glass transition) using dielectric relaxation spectroscopy. By comparing the dynamics of the corresponding pure PI homopolymers, the effect of confinement on the dynamics can be directly deduced.

In this communication we will present first results of a study of various PI-PDMS block copolymer melts where the PI part varies between 5 000 to 10 000 g/mole. Using small angle x-ray scattering (SAXS), we deduce the detailed structure and the ordering behaviour (crystal structure) of the system (see Figure 1). Dielectric spectroscopic measurements show that the confinement induces a faster and broadened normal as well as local relaxation process broadened having an extra fast relaxing component in the high frequency side of the dielectric loss peak (see Figure 2). Several scenarios to explain these findings, ranging from local density effects, and incomplete segregation to coupling of the PI chain dynamics to the interfacial PDMS motion will be presented.