

Abstract Submitted
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Nanostructures and nanosecond dynamics at the polymer/filler interface¹ TAD KOGA, DEBORAH BARKLEY, MAYA ENDOH, Stony Brook University, TOMOMI MASUI, HIROYUKI KISHIMOTO, Sumitomo Rubber Industries Ltd., MICHIIRO NAGAO, NIST/Indiana University, TAKASHI TANIGUCHI, Kyoto University — We report in-situ nanostructures and nanosecond dynamics of polybutadiene (PB) chains bound to carbon black (CB) fillers (the so-called “bound polymer layer (BPL)”) in polymer solutions (from dilute to concentrated solutions). The BPL on the CB fillers were extracted by solvent leaching of a CB-filled PB compound and subsequently dispersed in deuterated toluene (a good solvent) to label the BPL for “contrast-matching” small-angle neutron scattering (SANS) and neutron spin echo (NSE) techniques. The SANS results demonstrate that the BPL is composed of two regions regardless of molecular weights of PB: the inner unswollen region of ≈ 0.5 nm thick and outer swollen region where the polymer chains display a parabolic profile with a diffuse tail. In addition, the NSE results show that the dynamics of the swollen bound chains in the polymer solutions can be explained by the collective dynamics, the so-called “breathing mode”. Intriguingly, it was also indicative that the collective dynamics is independent of the polymer concentrations and is much faster than that predicted from the solution viscosity. We will discuss the mechanism at the bound polymer-free polymer interface at the nanometer scale.

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