

MAR05-2004-000193

Abstract for an Invited Paper  
for the MAR05 Meeting of  
the American Physical Society

**Nanostructure in amorphous poly(*n*-alkylmethacrylate) melt from dynamic NMR and scattering**

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Nanostructures are important aspects of composite polymers, such as block copolymers. Advanced solid state NMR techniques recently revealed, however, that homopolymers can also exhibit pronounced nanostructures. There, they arise from orientational correlations between neighbouring chains or from an incompatibility of different groups within the repeat unit. The presence of such nanostructures has important consequences for the dynamic behaviour and the properties of these materials. As a specific example, the complex dynamics of poly(*n*-alkylmethacrylates) is studied by advanced  $^{13}\text{C}$  NMR spectroscopy. Extended backbone conformations involving about five, at most ten repeat units are identified as the molecular units involved in structural relaxation. Syndiotactic and isotactic sequences behave alike. The packing within the locally structured polymer melts is reminiscent of hairy rods with flexible sidegroups, yet much less defined. It also shows up in temperature dependent X-ray scattering.