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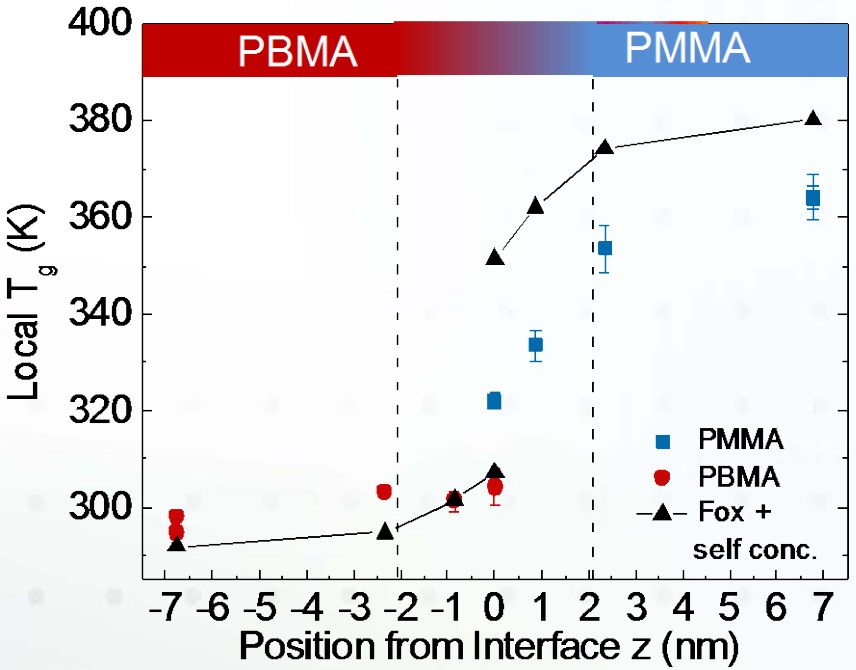
Direct Measurement of the Local Glass Transition in Nanophase Structured Copolymers with One Nanometer Resolution

Register and Priestley; 2017

Princeton University

Block copolymers, which self-assemble into nanostructures due to the incompatibility of each block, have generated intense scientific interest and are used in a myriad of important technologies. In such systems, the majority of the macromolecules can lie within a few nanometers of an internal interface, within a region where the dynamics and mechanical properties can be highly modified from their bulk values. The team has developed the first method to map the full distribution of dynamics at the interface and at prescribed distances away from the interface. We found that in the case of of lamella-forming diblock copolymers of poly(butyl methacrylate-*b*-methyl methacrylate) (PBMA-PMMA) a significant gradient in glassy dynamics existed, which had masked been all prior measurements. See Figure for snapshot of our findings.



Our findings will lead to a better understanding of the combined roles of interfaces, confinement and self-concentration effects on the properties of internally nanostructured polymers. The results will guide the development of next-generation copolymers with tunable interfacial properties.

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