CRYSTALLIZATION OF POLYMERS
AT INTERFACES AND IN THIN FILMS

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The structure and morphology of polymers at interfaces and in thin films differ substantially from that of bulk polymers which lead to important differences in resulting thermophysical properties. We have studied the interfacial crystallization of polypropylene and the thin film morphology of diblock copolymers containing amorphous polybutadiene (PB) and crystallizable polyethyleneoxide (PEO) blocks using temperature controlled polarized optical microscopy and atomic force microscopy.

When the number of nuclei for crystallization on a surface is sufficiently high, three dimensional growth is prevented and the polymer crystals grow predominantly in one direction normal to the interface forming transcristalline layers. The crystallization kinetics of polypropylene in the form of spherulites between two glass surfaces will be compared to the crystallization in the form of transcristals along various surfaces.

Thin films of PB-PEO block copolymers of thicknesses less than 1000 Å were prepared by spin coating from a solution in methyl-cyclohexane. The films showed a microphase separated lamellar morphology oriented parallel to the substrate, as indicated by AFM images showing typical island-hole patterns at the air/film interface. The lamellar period was observed to increase as the temperature was decreased towards the melting temperature of PEO. The systematic observations of morphology as a function of composition will be presented for block copolymers in which the PB molecular weight was kept constant at 3.7K and PEO molecular weight was varied from 2.9K to 5.0K.