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Pattern Formation in Thin Polystyrene Films

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Thin polystyrene films (30 nm – 300 nm, prepared in a sandwich geometry between two Aluminum electrodes) exhibit in ambient air at temperatures above the glass transition (i.e. 180 C) a pattern formation, while in a pure nitrogen atmosphere and in vacuum their geometry remains unchanged. This finding indicates an enhanced sample mobility in ambient air in comparison to that in a nitrogen atmosphere or in vacuum. As proven by Broadband Dielectric Spectroscopy, capacitive dilatometry and temperature-modulated calorimetry, this effect is caused by an increase in time of the average relaxation rate of the dynamic glass transition and a corresponding reduction of the glass transition temperature T_g . Measurements by Infrared-Spectroscopy reveal that the origin of this phenomenon is a decrease of the average molecular weight as a consequence of oxygen-induced chain scissions in ambient air.

References:

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