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Relaxation suppression in stretched block-copolymer matrix above T_g DMITRIY ALHAZOV, MICHAEL BURMAN, ARKADII ARINSTEIN, EYAL ZUSSMAN, Technion - Israel Institute of Technology — As was shown in our recent paper [1], electrospun thermoplastic polyurethane (TPU) block-copolymer nanofiber mats start massively to contract upon heating up to ∼90 °C, whereas cast TPU films expand as expected. Further studies have shown that such temperature threshold is an artifact caused by process kinetics. It also turned out that cast TPU films can also massively contract upon heating, but only after the following thermo-mechanical programming: stretching the films (∼100%) at high temperature (∼90 °C), cooling to room temperature under constant strain, and finally, unloading the stretched films. Such behavior in films demonstrates that the contraction in electrospun fibers cannot be attributed only to confinement. Rather, the phenomenon in question should be attributed to relaxation suppression in non-equilibrium (stretched) states of TPU polymer matrix. This conclusion is unpredicted since the temperatures of the tested samples (before heating) were much higher than the glass transition temperature of the soft phase, and the concentration of hard segments in TPU macromolecules is too low in order to form a percolated "solid" structure. In such a situation the relaxation of the non-equilibrium is expected. A possible physical explanation of the observed phenomenon, based on the blob concept, is proposed.

[1] D. Alhazov, et al., Euro. Polymer J. (2013).

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