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Size-dependent behavior of as-spun nanofiber vs. polymer molecular weight ARKADII ARINSTEIN, Department of Mechanical Engineering, Technion - Israel Institute of Technology — The size-dependent behavior of nano-objects is a well-known and widely-accepted phenomenon, but up to now it has no satisfactory explanation. From the physical point of view, such a behavior is to be related to an internal scale parameter which is comparable with the scale of the system. Recently Ji et al. showed that the elastic moduli of polystyrene nanofibers of different molecular weights can be described by one universal curve as a function of fiber radius, scaled by radius of gyration R_g (EPL, 84, 56002, 2008). However, the crossover to the size-dependent behavior in the above dependence occurs at $R/R_g \sim 25-30$, therefore the radius of gyration, R_g, is too small in order to play a role of the required scale parameter. This discrepancy requires an explanation. Utilizing a number of well-known scaling dependences, on the base of the model of confinement mechanism of polymer nanofiber reinforcement, proposed by us earlier, it is demonstrated that elastic modulus of polymer nanofibers is described by the function $F\left[(R/R_g)^{\alpha}\right]$ ($\alpha \sim 1.5$). This function, conforming to experimental observation, increases at small argument values, whereas for large argument values tends to value of the bulk elastic modulus, in doing so the crossover scale to the size-dependent behavior also agrees with experimental data.

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