Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

The Dynamic Reinforcement of Polyvinyl Alcohol (PVA) as a Result of Non-equilibrium State of Polymer Supermolecular Structures and their Confinement in Nanofibers EYAL ZUSSMAN, EMIL SHAKED, ARKADI ARINSTEIN, Technion — The results of mechanical testing of PVA -based electrospun nanofibers and bulk in static and dynamic modes are presented. An increase in the elastic moduli resulting from sample deformation was observed in both the bulk and as-spun fibers. This increase occurs when the deformation rate exceeds a critical value and can be attributed to the non-equilibrium dynamics of the supermolecular structures of the polymer matrix. That is, the evolution of these supermolecular structures results in an observably extended relaxation time. It is noted that the rate of the modulus increase of the nanofibers is nearly double that of the bulk fibers' rate. This difference can be explained by confinement influence on the polymer matrix of the nanofibers. In addition, the tests revealed that the, Tg, of the nanofiber is noticeably higher than that of bulk specimen. Reinforcing the nanofibrs by cellulose whiskers showing that the dependence of the effective modulus on the whisker concentration has an initial increase that changes to a decrease when the whisker concentration exceeds 2 %. Such behavior can be explained in the framework of an aggregation concept – when the cluster size reaches that of the fiber diameter (cluster confinement), the whisker distribution becomes inhomogeneous and results in a measurable weakening of the composite.

Eyal Zussman
Technion

Date submitted: 11 Dec 2008 Electronic form version 1.4