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Strong Keratin-like Nanofibers Made of Globular Protein YAEL DROR, VADIM MAKAROV, Technion, Mechanical Eng. Dep., ARIE ADMON, Technion, Biology Dep., EYAL ZUSSMAN, Technion, Mechanical Eng. Dep. —
Protein fibers as elementary structural and functional elements in nature inspire the engineering of protein-based products for versatile bio-medical applications. We have recently used the electrospinning process to fabricate strong sub-micron fibers made solely of serum albumin (SA). This raises the challenges of turning a globular non-viscous protein solution into a polymer–like spinnable solution and producing keratin-like fibers enriched in inter S-S bridges. A stable spinning process was achieved by using SA solution in a rich trifluoroethanol-water mixture with β-mercaptoethanol. The breakage of the intra disulfide bridges, as identified by mass spectrometry, together with the denaturing alcohol, enabled a pronounced expansion of the protein. This in turn, affects the rheological properties of the solution. X-ray diffraction pattern of the fibers revealed equatorial orientation, indicating the alignment of structures along the fiber axis. The mechanical properties reached remarkable average values (Young's modulus of 1.6GPa, and max stress of 36MPa) as compared to other fibrous protein nanofibers. These significant results are attributed to both the alignment and inter disulfide bonds (cross linking) that were formed by spontaneous post-spinning oxidation.

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