Hierarchical Structure of Cellulose Microfibrils for Regenerated Cellulose fiber

Dr. Jiliang Liu[1]
[1]ESRF
ligerliu@gmail.com

Cellulose in solution can be regenerated into textile fibers by wet-spinning (Viscose etc.) and dry-jet wet-spinning (Lyocell, Ioncell etc.). Both types of fibers have significant differences in mechanical properties, but no obvious structural differences visible with microscopic techniques in the range of 100 nm to 10 µm. In this work, we explicitly demonstrate the complete structural information on regenerated cellulose fibers(RCFs) at multiple scales. Using scanning X-ray microdiffraction(SXM), we identify the "skin-core" morphology of RCFs. The "core" of RCF is made of microfibrils(MFs) having size of ~100nm. MFs of Ioncell fibers contain homogeneous cellulose elemental fibrils (CEFs) having a ribbon shape of 6x2 nm, whereas MFs of Viscose fibers have great porous structure and highly heterogeneous CEFs. Furthermore, the cellulose molecular sheets within CEFs of Viscose fibers preferentially stack along the (0 1 0) direction, while the cellulose molecular sheets within CEFs of Ioncell fibers preferably align in the (1 1 0) direction. The great homogeneity of CEFs and low porosity within MFs is essential for Ioncell fibers achieving better mechanical properties than Viscose fibers.