Supplemental Information

Verification of Direction of Polarization and Related Herman’s Orientation Factor

The orientation factor obtained for PAN are different from most values reported in previous literature. The Herman’s orientation factor increases with draw ratio, however; the values remain negative and approach 0 despite post-drawing up to four times the initial fiber length. This would indicate polymer chain alignment perpendicular to the fiber axis at DR1 and a decrease in macromolecular order at DR4. In comparison, previous literature reports positive orientation factors approaching a value of 1, expressing polymer chain alignment parallel to the fiber axis. ThermoFisher had mislabeled their polarizer directions and issued a correction reversing 0 and 90˚ in January 2016. The updated labeling indications are shown in **Figure 1**. Given the uncertainty of the company with this device we wanted to independently verify that the polarizing lens was oriented correctly. To do this, spectra were collected using a wire grid polarizing film with known polarization direction in place of the installed lens **(Figure2)**. Using the polarizing film, the results were comparable to those obtained using the polarizing lens installed by ThermoFisher using the provided spec (**Figure 1**) for automated-track fibers collected at DR1, DR4, and conventional melt-spun PAN microfibers, produced by Sarchem labs **(Figure 3)**. To further verify the collected data and the manufacture’s statement regarding lens angle, the spectra was collected using the installed polarizing lens for five samples of melt spun micro fibers. The orientation factor calculated for microfiber samples analyzed with both the internal polarizing lens and polarizing film exhibited values consistent with literature **(Figure 3)**. We are confident that the Herman’s orientation factors presented in this manuscript are correct, because the orientation factors calculated for the melt-spun microfibers correspond with previous literature and the values remained consistent for both electrospun nanofibers and melt-spun microfibers when spectra were collected with a polarizing film of known polarization direction.

Figure S1: Thermo Fisher Nicolet IS50 Fourier Transform Infared Spectrometer with polarizing lens rotatable 180 degrees installed to control the direction of the electric field vector of the IR beam entering the sample compartment. When the polarization angle is set to 0 degrees the electric field vector is parallel to the sample compartment baseplate (blue arrow). And when set to 90 degrees it is perpendicular to the baseplate (red arrow)

Figure S2: Experimental setup for polarization verification. Absorbance values are collected with the polarizing lens set to 0 and 90 degrees (Left). The same procedure is completed using the polarizing film with a known wire grid direction in place of the ThermoFisher polarizing lens (Right).

Figure S3A: Herman's Orientation Factor Calculated using the ThermoFisher Nicolet IS50 Polarizing lens and polarizing film of known polarization direction . B: Herman’s Orientation Factor calculated using the installed polarizing lens and polarizing film plotted against backbone angle from the fiber axis.