Studies on the Melt Spinning Process of Rectangular PET Fibers

-Shape change during the spinline-

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In the past few years, there have been great progress on analyzing the melt spinning process[1-3], both theoretically and experimentally. It is the commonly used method to produce synthetic fibers like Poly(ethylene terephthalate) and Nylon etc.. And because of it's commercial importance, PET melt spinning is one of the most commonly researched subject.[4-5]

To analyze the spinning process of rectangular shaped PET fibers[6-7], a 1-D simulation was conducted giving fair results for most commonly used industrial spinning conditions.

Using a picard type iteration for the 1-D and 2-D simulation it predicts the shape and aspect ratio of the rectangular fibers at various positions from the die, fairly well with minimum calculation time. As well as the above the real dimensions of the fiber, temperature, spinning tensions at various points all fit very well with the simulation, thus confirming that the simulation performed in this study is applicable to most industrial melt spinning conditions of PET.

Experimental data show that the shape of the rectangular fiber is initially die swelled mostly to the short side, giving a fat looking cross section then deforms to a flatter shape as it reaches the freezing point. Additionally the shape is elliptic at a position close to the die, then changes to a more rectangular like shape toward the take-up device.

In view of the sensitivity of the spinning parameters to the shape of the fibers, the flow rate and spinning speed are dominant factors affecting

both the initial and final shape of rectangular fibers compared to spinning parameters like quenching air and spinning temperature.

References

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