Numerical analysis of fiber spinning process design for CNT/CSA solution

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On the molecular level, carbon nanotubes (CNTs) have outstanding material properties, making them ideal multi-functional materials that combine the best properties of polymers, carbon fibers, and metals. However, such properties have remained elusive on a macroscopic scale, because of an inefficient and irregular array of CNTs. Handling CNTs with sufficient length stiffness, and chemical inertness introduces significant challenges in material processing.

The use of CNT/CSA solution in the liquid spinning process can be expected to produce high-performance CNT fibers with uniformly arranged particles. Understanding the fundamental of CNT liquid crystals in CNT/CSA solution and analyzing the change of property of liquid crystal solution according to the microstructure change is an essential factor in the application of fiber spinning process. This study computes the fiber spinning process using numerical analysis with experiments. Velocity/stress data can be gathered based on computational data and the verification of this result was based on the asymptotic method using one-dimensional fiber spinning model.