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Abstract
Electrospinning is an important technique for producing nanofibers, it makes a polymer solution flowing in the static electric field by using the high pressure electric field, then gets fibers by the dissolvent evaporating and solid. Nanofiber is a kind of fibers about the diameter in the nanometer range(1~100nm), and length longer, it can use physical theory to develop the polyester of the nano crystalline dimensions, and makes the synthetic fibers have the characteristic of natural fiber, to make the cloth produced has shape retention and comfort. But the drawback of electrospinning is very low throughput, typical spun volume is in ml/h range. The solution to the issue lies in massive combinations of spinneret in linear or planar arrangement. But the interference of the electric field from multiple spinnerets and the force distribution less than satisfactory, so fiber motion from single spinneret needs to be simulated first.

The thesis has three studies：(1)We present a Particle-In-Cell code simulation on the space charge field distribution during electrospinning. (2)Manufacture of PVA nanofiber by electrospinning, observe the fiber structure become under the different jet distance, voltage and PVA concentration. (3) PVA nanofiber thin were placed in the sink to carry on the atmosphere presses, the salt ion transport experiment, observe the electrical conductivity and the ion flow rate of different concentrate salt, we also perform ion transport experiment with nanofiber and filter paper.

We present a Particle-In-Cell code simulation on the space charge field distribution during electrospinning. Nanofiber position, axial electric field, rho-direction electric field. The critical technique lies in controlling the space charge that nanofibers carry and the space charge field distribution during electrospinning, we found that the axial field is not always pointing towards the collector screen, and the complex field distribution is the cause of whipping instability evident in many experimental reports.

We make nanofibers of several cm2 area under 5-15KV voltage within 30 minutes, and when the increment of the voltage and jet distance, the thickness will become thinner and thinner, the diameter will become smaller and smaller. But when the increment of the PVA concentration, the thickness will become gradually thin, the diameter will enlarge gradually. In the experimental result, we found changing distance and voltage brings different results. The distance lengthens to make surface electric charge time of the function. As for the influence of the thin film thickness, because the high voltage gives the fiber the greater kinetic energy, making the thin film spreads more and fast, the

thinnest film achieved is 20μm thick, this can hardly reach in other methods.

We also perform ion transport experiment with nanofiber and ordinary filter paper, salt is the mainly solute, we found similar transport property at low ion concentration, but much stronger ion stopping power for nanofiber at high ion concentration, this might be due to the larger surface area effect.

In future research, if can disperse nanoparticles on the nanofiber, it will use the physical theory to expand its function and use.

Advisory Committee Shen Shou Chung - advisor

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