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Preparation and characterization of polysulfone filter materials based on the principle of electrostatic adsorption

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Abstract: With deep and rapid development of industrialization process, a lot of dust particles emissions into the air, including PM2.5 (particle size less than 2.5 μ m particulate pollutants) will cause extremely serious damage to human health, will lead to the occurrence of asthma, bronchitis, lung and cardiovascular disease and other diseases. In addition, PM2.5 will be greatly increased concentration of poisonous and harmful substances in the times and the fog haze weather, affect people's normal travel, the normal growth of plants and animals caused serious harm. If the atmospheric PM2.5 concentration is too high, may "food" in the atmosphere of the water, unable to gather the cloud in the sky, so blue sky and white clouds becomes scarcer than before. Therefore, it is an urgent task to effectively prevent particles from the air, and to reduce the harm to human health

Keywords: *ElectrostaticspinningInorganicresidentFiltrationefficiency polysulfone*

I. INTRODUCTION

Recently, the World Health Organization and the United Nations Environment Organization published a report to illustrate the current environmental situation, the report said: "air pollution has become an inescapable reality in the life of cities around the world." If the environment pollution is very serious, human beings will face the danger of all the death in a few minutes. Industrial progress and the city's rapid development, while creating enormous wealth for the mankind, but also the billions of tons of waste gas discharged into the atmosphere of human survival, resulting in the atmosphere become junk on the air base and gas reservoir. Therefore, when the air pollutants and harmful gases to a certain concentration, it will bring great disaster to human and environment.

Atmospheric particulate matter (PM) is an important part of outdoor air pollution, and has been classified as a human carcinogen (first class). Including PM2.5 (particle size less than 2.5 μ m particulate pollutants) will cause extremely serious damage to human health, if it is inhaled into the human body, directly into the bronchi, causing suffering from asthma, bronchitis, lung and cardiovascular disease and other diseases, which is caused by one of the main reasons for Chinese lung cancer patients a significant increase in the number. In addition, PM2.5 will be greatly increased concentration of poisonous and harmful substances in the times and the fog haze weather, and affect people's normal travel and the normal growth of plants and animals caused serious harm. If the atmospheric PM2.5 concentration is too high, may "food" in the atmosphere of the water, unable to gather the cloud in the sky, so blue sky and white clouds becomes scarcer than before. Namely atmospheric fine particulate matter (PM) at the same time to change the temperature and precipitation patterns, which led to the increase in the number of fog and haze.So how big is PM2.5? Tiny grains of sand, has a diameter of about 90 μ m, human hair, diameter is generally 50 μ m, that is to say about PM2.5 only human hair one thirtieth, the naked eye cannot see. Figure 1.1 PM2.5 size comparison.

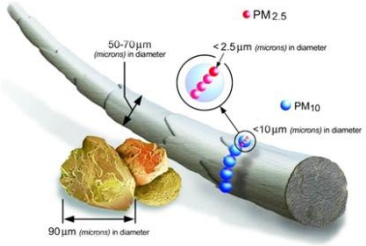

Figure 1.1 comparison of PM2.5 dimensions

In general, the smaller the particle size, the greater the site of entry into the respiratory tract. Human nose can help us resist particle size 10 μ m above the particulate matter; particle size of between 2.5 μ m to 10μm particles, although able to enter the upper respiratory tract, but part of the particles can excreted through the sputum and blocked by the internal nasal hair, for the health of human body harm is relatively small; however, the particle size in 2.5 μm or less fine particles, because it is too small, not easy to be organ of the body's own door barrier, can penetrate to the bronchioles and alveoli, gas exchange in the lungs of interference, will lead to the outbreak of cardiovascular disease, such as bronchitis and asthma disease include.

Therefore, the design and preparation of particulate pollutants in the air can effectively reduce the filter material is a major issue related to the health of people's livelihood. Since the late 80s of the 20th century, people increasingly attach importance to filter on atmospheric particulate matter PM2.5 research and therefore filtration material has also been rapid development, at present domestic and foreign research for air filtration material has the following several, meltblown, acupuncture, electrostatic spinning, in pole, spun bonding, or is a combination of the above process. Traditional filter material although for more than micron particle has high filtration efficiency, is difficult to achieve effective filtering of submicron (100nm~1.0 m), and particle size and anti pollution ability weak, cycle short defects, has been unable to fully meet the people of the high efficiency filter material filter. In order to make up for the deficiency of the traditional filter materials, the development of the new multi function and high added value filter material is imperative. Fiber filter material has the advantages of good workability, structure and function, and it has become the fastest and most widely used filter material in recent years.

II. AIR FILTRATION MECHANISM

Harm of PM2.5 and PM10 has already been mentioned in last chapter, this moment exists around us harm has attracted worldwide attention, and filtering is one of the most extensive air purification method therefore filtered materials research and development has become a top priority. Filtration is a combination of surface filtration and depth filtration, according to classical theory of fiber filter at the stage of filtration stability mainly five kinds of trapping mechanism of particles: gravity sedimentation, interception, inertial impaction and diffusion and electrostatic effect. Particle arrested sets are the result of several mechanisms, and one or more of these mechanisms play a major role.

2.1 Gravity sedimentation

Large particles in the air by the influence of gravity is separated from the airflow, direct settlement to the filter material, generally less than 0.5 μ m particles and gravity sedimentation can be ignored. As shown in figure 2.1.

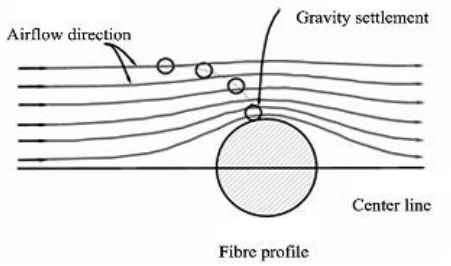

Fig. 2.1 effect of gravity sedimentation

2.2 Interception effect

Air filter material of fibre arrange complex. When the dust particles in the air in motion in contact to the surface of fiber filter material, the van der Waals force between the filter and dust is filter stick. The interception mechanism believed that the particle has the size but not the quality, therefore, the particle with different size follows the stream line movement, as shown in Figure 2.2. If

the distance between the center of the particle in a flow line and the center of the fiber is the sum of the radius of the fiber, the particle is considered to be a fiber.

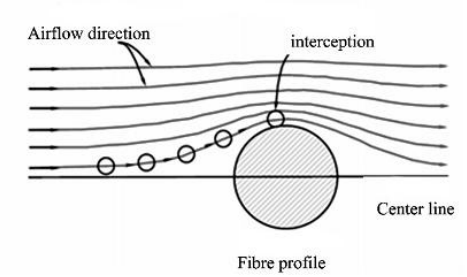

Figure 2.2 interception effect

2.3 Inertia impact

Air filter material fiber arrangement is complex, air flow through the material when the flow line in case of barrier turning, dust particles in the air in the role of inertia force from the flow line impact on the surface of the filter media and deposition. The greater the particle, the greater the inertia force, the greater the possibility of being hindered by the filter fiber, the better the filter efficiency. In the filter, when the particles through the fiber filter, when the airflow around the fiber cylinder, near dielectric fiber particle motion will change, due to the existence of inertial force particles from the initial movement direction to a lesser extent impact to the fiber surface contact, known as inertia mechanism, as shown in Figure 2.3. This action is usually applicable to particle size more than 1μm.

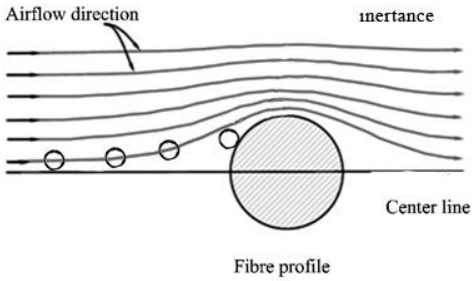

Fig. 2.3 effect of inertia impact

2.4 Diffusion effect

Irregular Brownian motion to do small dust particles, the smaller the particle Brownian motion is more obvious, the particle 0.1μm at room temperature diffusion per second up to a distance of 17μm and the distance than fiber spacing several times to ten times, which makes the particles have a greater chance to settle down[1]. Particles smaller than 0.1μm, Brownian motion, the smaller and more easily removed more than 0.5μm particles mainly for inertial motion, more tends to be removed; 0.1-0.5μm between the particles, diffusion and inertial effects are not obvious, and is difficult to remove. For fine particles, due to the impact of the Brown movement, when the particles through the fiber media will occur when the deviation from the rule of movement, which may be in contact with the fiber media and arrested sets. When particles and fiber size compared to the extremely small, Brownian motion dominates the motion of particles, smaller particles, Brownian motion is fiercer, diffusion and deposition effect significantly. Applicable to the particle size of less than 0.1μm particles, as shown in figure 2.4.

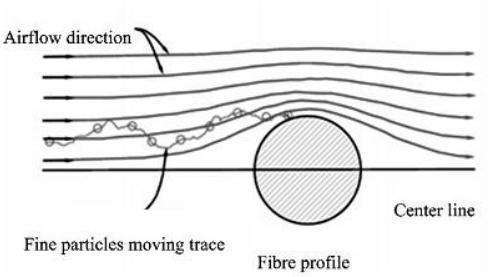

Fig. 2.4 diffusion effect

2.5 Electrostatic effect

Electrostatic are mainly two aspects: one is the static interaction dust change trace of streamline and deposited; the second is the electrostatic interaction so that dust more firmly stick on the surface of the fiber filter, electrostatic interaction does not increase the filter resistance can effectively improve filter effect rate. If the fiber filter material with weak electrostatic, regardless of the particles in the air itself is static, when they approached the fiber filter vulnerable to electrostatic attraction is filtered down. Electrostatic effect can help the filter material to improve the filtering efficiency without increasing the airflow resistance, as shown in figure 2.5.

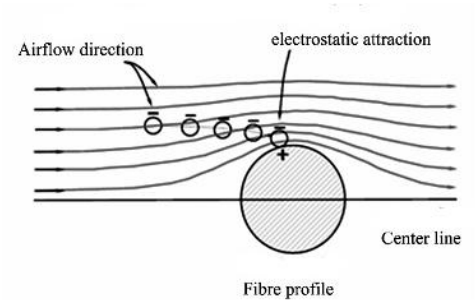

Fig. 2.5 electrostatic effect

Traditional air filtration materials mainly include asbestos fibers, polyester, acrylic and other synthetic fiber, glass fiber, but this type of filter material only to 0.3μm above the particles have higher filtration efficiency, and of sub micron particles and other smaller pathogens is difficult to achieve more effective filtering[2]. According to a large number of studies have shown that, the filtration efficiency of air filter material will improve fiber filter performance is a more effective method is increased significantly as the fiber diameter reducing, therefore, reduces the diameter of fiber[3]. Electrospinning process can be direct and continuous preparation of the sub micron and nano fiber, and it has high porosity and small pore diameter and large specific surface area of the structure, so compared to the electrostatic spinning nano fiber membrane with traditional media, has a higher filtration efficiency and better performance, particle filtering is effective. 1~0.5μm[4], so in the air filtration are widely studied and applied.

III. ELECTROSTATIC SPINNING TECHNOLOGY

The filtration mechanism of the electrostatic spinning nano fiber filter material is the steady state process, and the capture efficiency is not the simple addition and the efficiency of the collection efficiency, but the result of the 5 effects[5]. Electrospinning is a preparation with diameters ranging from several nanometers to a few microns ultrafine fiber is simple and efficient method, in the preparation of a fibrous filter by the widespread concern.

3.1 Principle of electrostatic spinning

Electro spinning technology is the use of extra high voltage electrostatic field on charged polymer solution or melt injection stretch to deform, so as to form a conical small droplets, and when

the droplet surface charge repulsion is greater than the surface tension of its own, in Taylor cone surface (usually in small droplets at the end) spray polymer solution a fine jet, jet in a shorter time and distance by high voltage electric field force of high-speed tensile, solvent volatilization, phase separation and curing and eventually deposited on the receiving plate, forming diameter range in tens of nanometers to a few microns of polymer fiber. The preparation process of the electrostatic spinning fiber is shown in Figure 3.1.

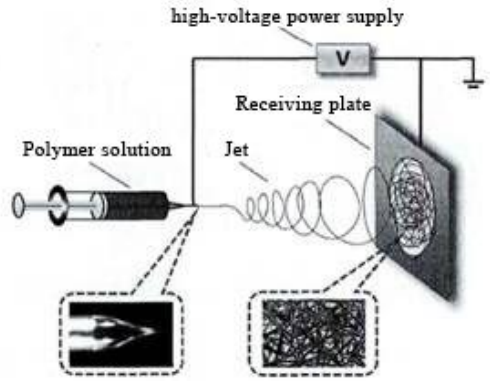

Fig. 3.1 electrostatic spinning process

Because, in the electrospinning process of preparing fiber mats will naturally formed between the fibers disordered pore structure, so electrostatic spinning preparation porous material mainly is the generation of single fiber pore structure. Research shows that through adjustment of electrospinning parameters or the electrospun fibers after treatment can be obtained with high specific surface area of porous structure in nano fiber, electrostatic spinning technology of preparation porous structure in nano fiber provides a simple, inexpensive, rapid and effective method.

3.2 Electrostatic spinning porous fiber

Material the filtration efficiency and fiber fineness, fiber surface holes have close relationship, in order to improve the filtration efficiency of air filter material can through the modification of the surface morphology of electrospun fibers, improve the pores on the surface of the fiber.

Porous material is the last century new material system, refers to the fiber surface with a large number of pores, so this kind of material has high porosity, high adsorption, high surface activity and great specific surface area and other properties, has great application prospects in air filtration, environmental science, separation film, barrier materials, bio medicine, energy, chemical engineering and national defense. The preparation methods of porous materials are sol-gel method, hydrothermal synthesis method and electrostatic spinning technology. The electrospinning technology is one of the production of porous fiber materials and the most simple and convenient, the most direct and the most economic method, and many of the polymer solution or melt can was used as raw material to prepare porous fiber material in different performance. In recent years, the research showed that by proper adjustment of the electrostatic spinning process parameters or the electrospun fibers after treatment, can be simple with porous structure of the fiber material, formation of the porous structure not only increases the fiber material specific surface area, but also improve the fiber material hydrophobicity, filtration, adsorption.

3.2.1 Study on the mechanism of the porous structure of the electrostatic spinning

Bognitzki[6] most as early as the electrostatic spinning fiber porous structure, in the process of electrospinning high volatile solvent volatilization resulted in the increase of the concentration of polymer solution, polymer solution by steady state into the metastable state and phase separation, finally polymer rich phase is formed the skeleton of the fiber, the fiber holes is solvent enrichment phase formation. Kongkhlang[7] et al studied the formation of porous structure of polymer fiber properties, spinning voltage, humidity and solvent, electrospinning of POM six fluorine isopropanol solution, when spinning humidity increases from 55% to 75%, the porous structure of the electrospun

fibers are more obvious, they explain this phenomenon as gas phase the induced phase separation mechanism; Barakat[8] et al by adding inorganic salts, the highly ordered porous microspheres, pointed out that it may be produced by the addition of inorganic salt, the solution viscosity decreased, the conductivity increased; Lin[9] et al was prepared by internal porous polystyrene fibers, and the effects of the concentration and different THF/DMF ratio the degree of solvent on porous. Jing[10] to study the influence of solvent on the PMMA electrospinning results, pointed out that the formation of solvent and porous microspheres The solubility and volatility has a great relationship, quick volatile solvent is easy to produce the porous surface structure, and poor solubility of solvent more easy to form microspheres; Pai[11] et al by establishing the phase diagram, the fiber pore forming mechanism is investigated, and points out that its internal porous formation due to insoluble agent air condensation water and quickly spread to the internal fiber, water and solvent are mixed with each other, leading to phase separation.

3.3 Preparation of air filter material by electrostatic spinning

Fibrous membrane filter material performance directly affect the final filtration effect, obtained by electrospinning technique and the diameter to the fiber diameter is several orders of magnitude smaller than the traditional method of, the diameter range for tens of nanometers to tens of microns, used in the air filtration material, with its own unique advantages.

3.3.1 Effect of the structure of the air filter on the filtration performance of the electrostatic spinning

The average diameter of the pore is usually referred to as the average diameter of the void, and the distribution of the pore size distribution is the percentage of all levels of the. Filter material of particle filter is mainly through the internal (fiber surface and fiber channel) to achieve the and pore diameters and their distribution in a great extent affect the filtration efficiency of filter material of particle size. Under normal circumstances, because of the electrospun fiber membrane with large specific surface area, small diameter and tortuous pore inner structure, compared to capture the particles whose diameter is less than 0.5nm particles, thus the material high filtration efficiency[12].

The filtration efficiency is the ratio of the captured particles in the air, which is a direct measure of the filtration performance of the filter. Filter accuracy is closely related to the diameter of the particle filter, and the filter accuracy is higher than that of a particle filter. Electro spinning fiber membrane has a complex and tortuous pore structure, and the pore size is up to sub micron level, so it has an absolute advantage to improve the filtration efficiency and filtration precision.

In the filtering process, the filter material inlet and outlet pressure difference exists between the filter resistance, also known as pressure drop. Fiber can make the air bypass, and then have some resistance, therefore, airflow through the filter when there is a pressure drop. Under normal circumstances, if the filter material fiber filling rate is high, the porosity is low, then the pressure drop is big; otherwise the small. Electrospun fibers have a large specific surface area, high porosity and aperture is more uniform, the fiber diameter is usually in the range of tens of nanometers to tens of micrometers range between, and through regulating power spinning process parameters can be obtained with different diameter fibers, is expected to greatly reduce the filtration resistance.

3.3.2 Factors affecting the effect of electrostatic spinning air filter material

The morphology of the polymer chain in the solvent can directly affect the property of the spinning solution, and it is a necessary condition for the successful preparation of the fiber material. The jets first a stable movement of the short distance, then entered the unstable motion stage, after a series of tensile, solvent evaporation, curing, and finally deposited on the receiving plate, the formation of polymer fiber. The electrospinning parameters including polymer solution properties, processing parameters and environmental parameters; process parameters, including applied voltage, solution injection speed, fiber receiving distance; environmental parameters including temperature, humidity, etc. will influence on fiber morphology. These parameters are often mutually constraining mutual influence[13].

3.3.2.1 Polymer solution properties

The solution properties of the polymer mainly include molecular weight, solution concentration, viscosity, surface tension, electrical conductivity and so on. The relative molecular weight of polymer is one of the important parameters affecting the electrospinning solution, which directly affects the rheological properties and electrical properties of the polymer. If there is no sufficiently large molecular chain of polymer, solution jet in the electrostatic field by stretching the role, if between the molecular chains of no entanglement or tangled, rarely, it can not effectively resist the external forces, which occurred in the fracture. In short, the small molecule solution is not to be able to carry out the electrostatic spinning. When polymer relative molecular mass is determined, and under other conditions to determine and solution concentration are important factors affect molecular chains in the polymer solution in the tangled, concentration is high, the greater the viscosity, the higher the degree of entanglement, thus fiber bead disappeared gradually, increasingly large diameter; determine the concentration of, reduce surface tension, is conducive to the formation of continuous fiber and reduce the production of the beads, the conductivity of polymers is the important factors of affecting the fiber morphology and high electrical conductivity of polymer solution on the formation of the jet susceptible to the action of electric field force, and low conductivity solutions of the jet less susceptible to stretching effect of electric field force, easy to produce beads fiber.

3.3.2.2 Electro spinning process parameters

The machining parameters mainly include the applied voltage, the injection speed, the receiving distance and so on. In the electrospinning process, increasing voltage which is to enhance the electric field strength, thereby enhancing the polymer surface charge, the Taylor cone will appear beating and back to the spinneret internal, the fiber diameter deviation becomes larger, but the yield of fiber will improve. In the electrospinning process, the Taylor cone shape will change with the change of injection speed, injection speed is too low, the Taylor cone will become unstable and increase the instability of jet; if the injection speed is too fast, the Taylor cone will bounce occurs, thus affecting the fiber morphology; fiber receiving distance directly affect electric field intensity, thus affecting the jet in the electric field in the tensile strength and the time of flight. When the fiber distance is too small, can't completely volatile solvent, fiber membrane prone to fibroarthrosis even soluble film phenomenon, an appropriate increase in the acceptable range, contribute to the solvent evaporation and the fiber tensile, which is easy to get thinner both hook fiber.

3.3.2.3 Environmental parameter

Environmental impact factors mainly include environmental temperature, humidity, etc.Electrostatic spinning technology is generally carried out at room temperature, and the increase of ambient temperature will be conducive to the movement of the molecular chain in the jet, improve the conductivity of the solution, reduce the surface tension and viscosity of the solution, improve the solution. However, electrostatic spinning as the temperature increased, will lead to increased the speed of volatile solvents in jet fast, and jet rapid curing, reducing the jet stretch time, final fiber diameter increased; the humidity of the environment has a direct impact on the nature of the medium around the jet, especially and dissolving agent compatibility. If water and solvent compatibility is good, reduce the humidity environment, there will be beneficial to the volatilization of the solvent in the jet, jet curing speed faster, the fibers are not easy to occur between the adhesive and good curing; adhesive fiber form, on the other hand, jet in solvent is not easy to remove. The porous structure and the surface roughness were obtained by using the high volatile solvent and the hydrophobic polymer. These influencing factors are not isolated, they are the morphological structure and functional properties of the electrostatic spinning fibers.

3.3.3 Research status of air filter materials for electrostatic spinning

Gopal [14] using electrospinning technology to prepare poly (fluoride fluoride (PVDF) fiber membrane, for the removal of 5~10 m polystyrene particles, the film did not cause damage to the case, the separation efficiency reached 90%. Yun[15] with pan (PAN) prepared by the average diameter of the 270~400nm range of the electrospinning fiber membrane, and tested its effect on the filtration of the

below 80 nm NaCl particles. Wang[16] spinning of fiber mean diameter of 200nm, aperture of 1-10μm, thickness of 350μm of polyoxyethylene (PEO) nanofiber mats, and the average fiber diameter of 500nm, aperture 0.5-8μm, 400μm in thickness of polyvinyl alcohol (PVA) nanofibers felt. Test results show that: the filtration capacity of the two kinds of fiber felt is better than the traditional air filter media, and PVA nano fiber felt as the average pore size is small, the permeability is not as good as PEO nanofiber felt. Liudong[17] by electrostatic spinning technology of preparation of high specific surface area of polysulfone (PSU) pre filter, as a pre-ultrafiltration and nanofiltration membrane filter.

3.3 Polymer used in electrostatic spinning technology

In recent years, the electrospinning technique has been used in dozens of different polymers, which includes a large variety of the traditional technologies for the production of synthetic fiber, such as: electrostatic spinning of polyester, nylon, polyvinyl alcohol and other flexible macromolecule, including polyurethane, butadiene styrene block copolymer (SBS) elastomer electrostatic spinning and liquid crystalline state of rigid polymer of poly (phthalic acid diphenyl amine electrospinning. In addition, including silk, spider silk, including proteins and nucleic acids and other biological macromolecules have also been carried out electrostatic spinning. After high voltage electrostatic field spinning, we can get the polymer fibers with a wide range of diameter distribution (usually a few microns to tens of nanometers).

With in-depth study on electrospinning technology, by electrospinning technique has the system prepared nearly 100 kinds of polymer nano micron fibers[18], these polymers includes both proteins, chitosan, cellulose, etc. some natural polymers, including polyacrylonitrile, polystyrene, polyurethane and poly cool and polyvinyl alcohol polymer. Bisphenol A polysulfone resin is a kind of main chain containing sulfone group and aromatic ring polymer[19]. From the structure (schematic diagram is shown in Figure 3.2) can be seen on both sides of the sulfone with benzene ring to form a conjugated system, due to the sulfur atom in the high oxidation state, coupled with the sulfone. Base on both sides of the highly conjugated, so polysulfone resin has good oxidation resistance, thermal stability and melting temperature stability[20].

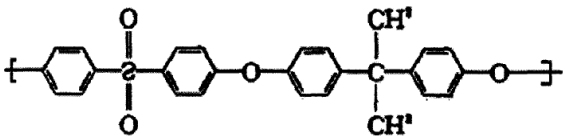

Figure 3.2 schematic diagram of the linear structure of Polysulfone

PSU is a with good resistance to chemicals and the thermal stability of the polymer, the electrospun fiber membrane has excellent high porosity, high gas permeability and high specific surface area, has been widely used, such as microfiltration, ultrafiltration, reverse osmosis, separation of ethanol / water, alkene / alkane separation, gas separation, hemodialysis analysis. PSU was used as a spinning polymer, DMF as solvent, and the solution was made into spinning solution. Under certain conditions, the PSU nano fiber membrane was obtained. The fiber membrane as a filtering membrane or pre filter can out size is larger than the critical membrane pore size of particles, no blockage; if the particles are smaller than the critical membrane aperture, absorbed by the nano fiber, can be used in depth filtration.In conclusion, the known electrostatic spinning materials with high porosity (fiber disordered pore structure), larger specific surface area, fiber diameter range in ten nanometers to tens of microns, so in air filtration field has a good prospects for development. This paper aims at the basis of the basic properties of the electrospun do modification to increase the porosity of the material, improve the efficiency of filtering materials; at the same time in order to further improve the performance of filter material, polysulfone is selected in this paper has good thermal stability, acid and alkali resistant (PSU) resin as electrospinning polymer, study the relationship between the number of holes on the surface of high volatile solvents the ratio of chloroform and fiber, in order to improve the filtration efficiency, mainly by using the electrostatic precipitator of this mechanism, the electrostatic precipitator has been carried out in the second chapter, the electrostatic precipitator is mainly depend on air filter material in electrostatic field up to hundreds of thousands of volts, the

electret pretreatment can get hundreds of thousands of volts electrostatic field. At the same time, electrospinning is one of the most important methods in the polar method, which can be a step by step method of the electrode material, which has the advantages of simple operation, low cost and so on.

IV. RESIDENT POLE PROCESSING

In the new filter material research, electret filtration material has been widely concerned, electret filtration material is of traditional nonwoven material for electret treatment, to take charge and to use static electricity to capture the dust particles in the air, has a higher filtration efficiency compared with the traditional air filtration materials, lower the air resistance characteristics.

4.1 Electrostatic resident pole method

The electrostatic resident electrode method of air filtration material mainly has the corona discharge, the friction electrification, the electrostatic spinning, the thermal polarization and the low energy electron beam bombardment. Its resident pole mechanism is shown in table 3-1.

Table 3-1 the mechanism of electrostatic

Resident pole method	In polar mechanism
corona discharge	The ion beam generated by the corona discharge of the air caused by the non-uniform electric field is used to bombardment the dielectric and make it live. Charge charge can only be deposited on the surface and near surface of the sample; the lateral uniformity of charge density and the stability of charge charge is poor.
Friction electrification	Two the friction contact distance of the object is small enough to generate heat excitation function, which makes the electron transfer between different objects and the object is charged. The relative humidity, the water absorption of the fiber and the temperature have obvious influence on the electrostatic properties of the fiber materials.
Thermal polarization	Under high temperature field, the thermal activation of the dielectric material is oriented along the direction of the electric field, and the dipole is frozen in the same electric field at low temperature. Heat in the polar body is affected by the storage temperature; the maximum charge density depends on the pressure and relative humidity.
electrospinning	Charged polymer solution or melt flow and deformation in the electrostatic field, and then

	by solvent evaporation or melt cooling and solidification, if in the spinning solution to join the polar body, can be a step in the preparation of the polar body material. The method is simple and easy to operate.

According to the comparison of the above mechanism, we can know that the electrostatic spinning method can take the filter material of the polar body step by step, and the method is simple in process and low in cost. Electrostatic spinning process requires high voltage static, if the fiber material itself has a good charge storage properties, then the final product also has a good charge storage properties, excellent performance in the polar body. So it is worth emphasizing is that obtained by electrospinning method of material charge storage capability is mainly polymer's electrical properties, fiber diameter and the medium structure determined, and applied technology parameters related to the charge does not matter, so in order to make the final material has stable electrical charge storage ability, select excellent electret is the core content of this topic is very important.

4.2 Overview of the polar body

In the polar body, which can store space charge and dipole charge in a long time, that is, from the time span, their charge decay time constant is much longer than the period of the formation of the polar body. The charge in the polar body can be a real charge (or space charge), or a dipole charge, or both. In this paper, based on the effect of electrostatic charge, the air filtration material of the.

The fundamental property of the polar body is charge storage. But the electret and battery is not the same, the battery is to provide charge or energy substance, and electret is both sides are fixed positive and negative charges, and make other substances induced charge and electret on humidity particularly sensitive. The resident polar body comprises a biological electrode, an organic polar body and an inorganic polar body. For inorganic in polar body, if the two surface is open, it can maintain the stability of the surface charge. However, the preservation of the organic electret surface charge is more complicated, usually if under short circuit condition, placed in a humidity less than 80% of the atmosphere, using the dry, is the surface charge will be re; but once the open circuit placed on the humidity greater than 80% of the atmosphere, surface charge will get serious attenuation and beyond recovery. So it is important to study how to maintain the stability of the surface charge of the polar body. General surface charge is divided into two categories: A is the surface charge of the symbols and charge where the surface has the same polarity with charge ", another is contrary polarity of the surface charge and the charge is located on the surface of the" opposite charge ". As shown in figure 3.1.

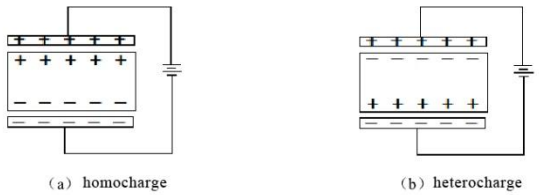

Fig. 3.1 homocharge and heterocharge

4.3 Current status of the research on the filtration materials of the polar body

Ying Hui Wang[21] tested different surface density of polypropylene fiber needle electret filtration material and experienced the rainwater leaching and water immersion, filtration performance, analyzing the reasons for the change of filtration performance, put forward the suggestions about the use of electret filtration material. Chen Gangjin[22] used the soaking method to study the stability of the filtration efficiency of the material under the action of medical disinfectant. The results showed that the hydrogen peroxide, phenol, glutaraldehyde, chlorine containing disinfectant, boric acid,

formaldehyde, peracetic acid and alcohol disinfection, medical disinfectant soaking, filtration efficiency almost no attenuation. However, the filtration performance of the material is decreased greatly when the material is cleaned with detergent and washing powder. Hui Ming Xiao [23] determination of the melt blown polypropylene electret air filtration material of ionic (KCl), polar non ion type (dehs) two different experimental aerosol particle filtering performance, the particle size, charge characteristics and flow rate on the performance of the filter effect, analysis of the inertial effect and diffusion effect and electrostatic effect on the particle capture capacity of the contribution. Lipeng Cheng [24] respectively to material thickness, charging voltage and parameters, using self-designed corona charging device, measuring polypropylene non-woven fabric surface potential changes of these factors of surface potential, the electret material permeability and filtration performance of the effect of charge for time and distance between electrodes.

V. CONCLUSION

Conventional meltblown non-woven electret material after in the pole, electric charge on the surface of the with a higher filtration efficiency, but the charge stability is easily affected by the environmental impact and charge decay deceleration rate faster, filtration efficiency dropped accordingly. In addition, the standing process as a must after treatment process also increased the cost of production to a certain extent. In order to overcome the meltblown electret filtration material, through electrospinning technique step of preparation charge stability is strong, and has high filtration efficiency and low air resistance of electrostatic spinning / electret composite fiber membrane material is imperative.

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