



The preparation and properties of high-performance PTFE coated membrane filter

Currently, the handling of flue gas, dust mainly adopts bag dust removal, bag filter bag filter material mainly selects the aramid amine fiber, and d, PPS fiber, poly (aromatic phthalein imide fiber, etc. Although these have different optimal glass fiber bag filter, with different properties of flue gas, dust, there are also different, such as aromatic poly phthalein amine fiber with moisture and chemical composition point temperature will reduce operation, especially in the SOX exist, with moisture, will be corrosion, strength retention; PPS fiber is sensitive to oxidant; Poly (aromatic phthalein imide fiber resist to hydrolysis, and high prices; The glass fiber of hydrofluoric acid, strong alkali corrosion resistance is poor. These problems will be in practice to reduce the service life of the bag, and make the bag filter machine for the inefficiency of flue gas, dust processing, at the same time, the effect filter continuous normal work of the machine. Therefore, the project, on the basis of traditional bag filter with filter material, combine the company of PTFE membrane and to develop a high performance fiber production process of pure PTFE (PTFE) coated filter material manufacturing process, namely, the company produced PTFE film materials, process such as fiber, woven, composite filter material. Production of pure PTFE filter material, this method possesses short process flow, simple operation, low cost, easy to mass production, etc.

Experimental section

Materials and equipment

PTFE microporous membrane, PTFE fiber and PTFE needled felt all made for this project; Hydrogen peroxide, concentrated ammonia are analytically pure; Distilled water is homemade. Tectorial membrane unit is homemade.

Production process of PTFE coated filter material

PTFE staple fiber→PTFE fiber mesh

(PTFE high strength and low stretch base fabric carding and laying)

→High density acupuncture→High temperature heat setting→PTFE needle felt→PTFE film polymerize→PTFE acupuncture felt film filter material

Base fabric as skeleton of needled felt filter material, has an effect on enhancement ;In the process of needle, first will be through a certain process of PTFE with short fibers compressed into netting, then press base fabric in the middle with two fiber webs (upper 、 lower has a web respectively), and then through the two processes and the main acupuncture needle, after a certain thermal setting process, finally get needled felt; tectorial membrane divided into resin coated and hot laminating, its purpose is to combined with PTFE membrane on the surface of needled felt, to further improve the physical and chemical performance of needled felt, make its surface level off





smooth, not easy to be blocked by dust, high chemical stability, with resistance to high temperature, high humidity, corrosion resistance, wear resistance, high filtration precision, easy to, etc.

The results and analysis

Component analysis of pure PTFE coated filter material

Figure 2 is the infrared spectra of pure PTFE coated filter material, figure 3, 4 respectively the base cloth of the filter material and the surface of the DSC analysis.

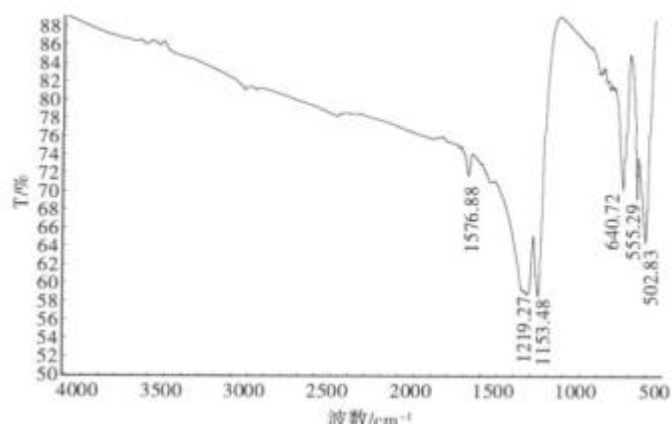


Figure 2 Infrared spectrum of pure PTFE coated filter material

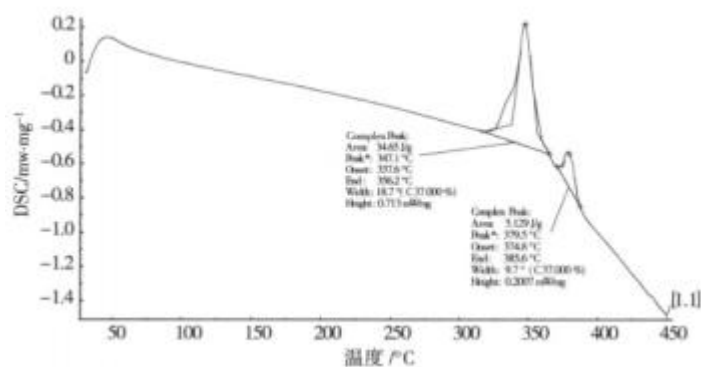


Figure 3 DSC analysis of pure PTFE coated filter material base fabric



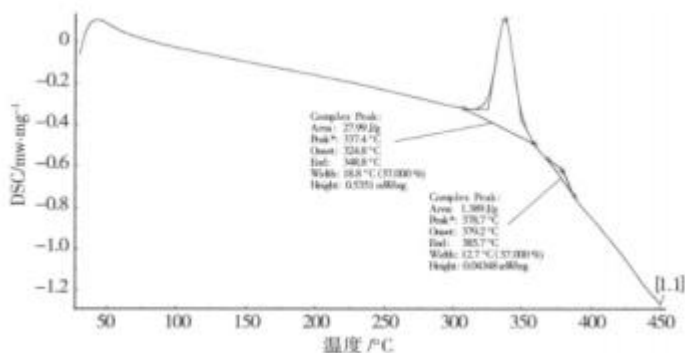


Figure 4 DSC analysis of pure PTFE coated filter material layer

Figure 2 shows that in 150 cm⁻¹ and 1200 cm⁻¹ has two strong bands, near for PTFE characteristic absorption peak, this is - CF₂ stretching vibration peak; In the range of 500 ~ 850 cm⁻¹ a series of bands come from vibration peak PTFE amorphous area. After PTFE resin and fiber, and then with the base fabric needle punched felt, after laminating into filter material processing, the band was not found. Figure 3 and figure 4, with ir spectrum and DSC analysis, can know PTFE coated filter material is made of pure PTFE.

Electron microscopy of pure PTFE coated filter material

Figure 5 is pure PTFE coated filter material longitudinal section electron microscopic photograph.

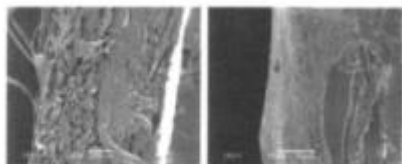


Figure 5 100% PTFE coated filter material longitudinal section electron micrograph

Pure PTFE coated filter material is based on PTFE fabric as substrate (FIG. 5 longitudinal section electron micrograph middle coarser fiber is the Teflon long fiber), through the acupuncture of different fineness of PTFE staple fiber, and at the completion of needle-punched process on one side of the filter material, a layer of PTFE membranes made of compound. PTFE fiber and PTFE microporous membrane layer have good bonding properties, which in the mechanical properties of pure PTFE coated filter material can be well reflected. Figure 2 ~ 4 did not show a new absorption peak, it shows that it does not form new chemical bonds between PTFE microporous membrane and PTFE base fabric, just rely on the role of high temperature melt to produce high temperature thermal bonding effect.





Figure 6 is pure PTFE coated fiber filter material surface electron microscopic photograph.

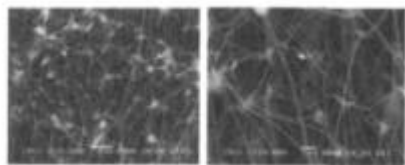


Figure 6 pure PTFE coated fiber filter material surface electron microscopic photograph

Figure 6 shows that, due to the special structure of PTFE microporous membrane, made of pure PTFE coated filter material surface without the straight hole, the dust can't through the membrane surface to the interior of the membrane or base material, the only through the dust and gas or withholding material on the surface of the membrane surface filtering approach is called filtering. In addition, the low surface tension of PTFE membrane which has the good non-stick performance for powder. Trapped and dust or material not like traditional filtering method in the filter material surface form thicker filter cake, don't blow will not be able to continue to work, instead reaching a certain thickness fall off automatically from the surface of the filter material. So using PTFE coated filter material filter bag won't cause the system pressure to rise continuously, instead the basic stable state of stress.

Performance metrics of pure PTFE coated filter material

Pure PTFE coated filter material performance is: the surface density is about 850 g/m², thickness is about 1.5 mm, 127 Pa pressure ventilation quantity is 25 ~ 40 L/m² s., continuous working temperature 260 °C, instantaneous temperature 280 °C, and the breaking strength is 800 N / 5 cm or more, heat shrinkage rate < 1%, the shortest service life of four years or more, resistance to pH range of 0 ~ 14, no oxidation, no hydrolysis. Ultrafine PTFE fiber layer surface level off, the PTFE film plays a supporting role, make it not easy to damage, and can have quite good protection effect. PTFE crude fiber layer contained in crude fiber make the pore enlargement, increased ventilation volume, greatly reduce the filtering resistance PTFE base cloth for the skeleton, keep high strength making warp/weft to fiber, and guarantee the stability of the size of the filter material, to strengthen the role of filter material. High and low temperature resistance of pure PTFE gradient effect of filtering material, acid and alkali resistance, especially the resistance to high sulfur, high humidity, excellent chemical stability, and filtering channel to gradually form a gradient from small to large, therefore, in process of filtering and ash removal, gas flow rate of filter material increased significantly, the filtering efficiency, filtering speed, high dust removal ability, little resistance during operation, soot cleaning frequency is low, service life is long, not only make the energy consumption dropped substantially, also reduces the maintenance workload and the costs of spare parts and other investments.

Pure PTFE coated filter material performance comparison with ordinary filter material





Pure PTFE coated filter material compared with the performance of several kinds of filter material shows in table 1.

Table 1 pure PTFE coated filter material compared with the performance of several kinds of filter material

project	PPS/ polyphenylene sulfide	Nomex / Aromatic polyamide	P — 84 / Polyurethane amide	Fiberglass	PTFE
Continuous operating temperature / Instantaneous temperature /°C	190 /200	204 /220	240 /260	260 /280	260 /280
the performance of wear-resistant and folding	good	good	good	bad	good
The hydrolysis resistance	perfect	good	general	general	perfect
Alkali resistance	perfect	good	general	bad	perfect
Resistance to organic acid	perfect	general	good	good	perfect
Resistance to mineral acid	perfect	general	good	good	perfect
The oxidation resistance	bad	general	good	good	perfect

Table 1 shows that only the glass fiber and pure PTFE coated filter material of continuous operating temperature can reach 260 °C, the instantaneous temperature reached 280 °C. Due to the temperature tolerance is one of the important indicators; bag filter is expected to run as a result, the pure PTFE and glass fiber has more advantages. But because of work in the bag filter process, the need to repeatedly to injection of filter bag, stripping absorption in thin film on the surface of the particles, filter bag need wear and fold reciprocating back and forth, and glass fiber wear-resisting performance is poor, therefore, compared with the traditional effect of filter material, pure PTFE coated fabric more can satisfy the requirement of high temperature, high humidity and high corrosive flue gas dust removal.

The application prospect of pure PTFE coated filter material

Pure PTFE coated filter material because of its high temperature resistance, corrosion resistance and high filtration efficiency, excellent performance, fully competent control of PM_{2.5} particulate matter. Compared with PTFE microporous membrane filter material, PTFE coated filter material can make the dust filter from conventional deep filter into a surface, thus to improve filtration efficiency by an order of magnitude, filtration efficiency of PM₁₀ lab reaches 99.999%, filtration efficiency of PM_{2.5} reaches 99.95%, almost zero emissions, its service life can reach more than 10 years, has the high cost performance.

