Feedback on PFAS Proposal (Giant Plastic)

Section 1: Personal Information (omitted)

Section 2: Organization Information (Company Profile)

Zhejiang Juhua Co., Ltd. Electrochemical Plant is a company committed to be the world's first-class green high-end functional materials enterprise, with more than 1200 employees, we deeply research and development of new materials and industrialization for decades, develop up to now, we have a number of international advanced industrial production equipment. The main products of our company are NaOH, Cl_2, $CaCl_2$ and other basic chemical materials, VDC, TCE and other chlorine-containing chemicals, as well as PVDC, PVDF and other polymer resin products, which are widely used in various industries. In recent years, PVDF become a popular fluoropolymer material in the industry, which is also the first priority industries we plan to develop in the future.

Section 3: General information

Para 1 (Beginning)

On behalf of Zhejiang Juhua Co., Ltd. Electrochemical Plant, we would like to send our sincere respect to the ECHA and functionary of PFASs.We have been making unremitting efforts to comply with domestic and international regulations, and continue to conduct strict self-review of products exported to the EU for compliance.We have long supported ambitious attempts by the EU to reduce the risks caused by toxic and hazardous substances and to take practical measures in good faith to meet the requirements of EU chemicals regulations, including REACH.

Para 2 (Elaboration)

Zhejiang Juhua Co., Ltd. Electrochemical Plant is a main fluorine, chlorine-containing fine chemicals and polymer materials enterprises.We produce fluoropolymer PVDF, because of its unique physical and chemical properties, this kind of material has a wide range of applications in various industries.Many PVDF-based polymer composites have been developed for research in frontier areas of science and technology. PVDF is used as a key raw material in many fields such as green energy, life and health, green and low-carbon, such as lithium electric diaphragm, water treatment film, backing materials of Solar PV and other materials which use a large amount of PVDF to meet the unique requirements of piezoelectric properties, weather resistance and processing performance to the greatest extent. Since PVDF has been widely used in these uses, showing performance effects that are almost impossible to achieve with other materials, no potential harmful factors have been found so far, there is no need for replacement, and it is really difficult to achieve replacement, it is expected that with the progress of science and technology in the future, some of the potential hazards of PFASs can be solved. We therefore request an exemption for the use of PVDF materials.

Para 3 (Conclusion)

In lithium-ion batteries, injection pipe fittings, water treatment membranes and other uses of PVDF materials, PVDF materials mainly realizes the necessary chemical resistance, mechanical strength, biocompatibility, unique piezoelectric properties and so on.Specifically, in the preparation of lithium-ion battery slurry, the processing of chemical resistant pipes, and some medical device applications, PVDF is one of the few materials that can meet these performance requirements at the same time, and there is currently insufficient evidence that PVDF has foreseeable hazards. At present, the alternatives that exist on the market and are mentioned in the draft cannot be replaced completely, and even if they can be replaced, they can not be applied in force in such a short time, because the evaluation of raw material substitution need a long period.

Para 4 (supplementary sentence)

Please refer to Section IV/V of Annex for detailed discussion, physical property comparison data and citations.

Section Ⅲ Specific Information Questions (Questions 1 to 10 Optional)

Q.1: (final) product area/use (ref: Table.8, Annex XV pp.80~114)

The key components of the battery raw materials, mainly lithium ion battery binder, diaphragm and other purposes.

Q2: Emissions at each stage of manufacturing/use/waste

According to the company's production data, the manufacturing stage emissions of about 1800 kgce/t, the use of the stage does not produce emissions, on the contrary, the promotion of battery energy storage is conducive to reducing carbon emissions, taking new energy vehicles as an example, the life cycle of carbon emissions reduced by more than 40% compared with fuel vehicles.The waste stage, such as power batteries can be recycled, downgraded and reused as energy storage batteries. PVDF waste resin that has lost its use value can also be recycled through green recycling technology, and there are many companies engaged in plastic recycling that can achieve PVDF recycling.

Question 3: Incineration treatment related

Q4: Impact on the recycling industry

Q5: PFAS usage and emissions for extended (derogation) applications

Q6: Limit information on alternatives and socio-economic impacts for uses omitted or not carefully explored in the draft

Q7: Information on alternatives and socio-economic implications of reconsidering extended use after soliciting comments

Q8: Information on alternatives and socio-economic impacts for other specific uses

Q9: Possibility of substances excluded in the draft restriction (paragraph 1) to decompose into specific subgroups of substances (additional information)

Q10: Information about PFAS analysis methods

Section IV: The attached information can be disclosed

Energy, information and materials are known as the three pillar industries for the development of human society in the 21st century, of which materials are the basis for human survival and development. It is the development and revolution of new materials repeatedly that human civilization can make rapid progress. Today, the development of this material technology, which affects the future and destiny of mankind, is facing great risks and challenges.

1. Development history

PVDF has more than 70 years of development history, in 1944, the United States DuPont company successfully synthesize PVDF for the first time. By 1960, the American Ponwater company was the first to realize commercialization, and the initial market use was mainly military insulated heat shrink tubes and thermal scanning wires. In the 1970s, PVDF began to be widely used in construction painting, chemical plant plastic steel and paper pulp processing. By the 1980s, the National Electrical Code of the United States advocated the use of PVDF materials as insulation sheathing for alarm lines in buildings and ceiling partitions. Also in the 1980s, high-purity semiconductor manufacturers began producing plastic pipes made of PVDF in computer equipment. In the 1990s, PVDF began to be used in high-purity machined parts such as pipes, tank linings, pumps, and architectural coatings. By the end of the 1990s, PVDF began to be used as an electrode adhesive in new liquid lithium-ion batteries.

PVDF materials originated in the United States from the earliest, and then introduced to Europe, Japan, the former Soviet Union, PVDF technology is constantly innovating and improving, and there are new products and new processing technology launched, promoting the application and development of PVDF products, people have developed hundreds of functional components. At the same time, it has also achieved a number of multinational companies producing fluoropolymers, such as DuPont in the United States, Daikin in Japan, Asahi Glass, and Solvay in Europe. In China, the formation of Juhua group, Dongyue group, and other large enterprises was initiated. Nowadays, PVDF materials are an important component of human life and are an irreplaceable component in many fields.

2. Performance characteristics

PVDF is a copolymer of vinylidene fluoride homopolymer or vinylidene fluoride and other fluorinated vinyl monomers, it is the world's second-biggest fluorine-containing polymer after PTFE, widely used in computer, aerospace, information processing, audio equipment, medical equipment, robotics, physical testing, optical instruments, weapons industry and so on.

In addition to the excellent properties of PTFE, PVDF's rigidity, hardness and creep resistance are especially outstanding, and it is the strongest fluorine plastic. PVDF has a low melting point (about 170℃), convenient molding, and can be processed by general plastics processing technology, such as injection, molding, extrusion, blow molding and other processes, and is the only material that can be made into hard tubes in fluorine plastics. Not only excellent processing characteristics, its radiation resistance and mechanical properties are also very significant, and the tensile strength can reach 50 MPa, almost twice that of PTFE. PVDF adhesion to the metal surface is very high, so that its life as a metal pipe lining, reliability is greatly improved.

The C-F bond in its carbon fluorine molecular chain has a small bond distance and low bond energy. This short bond structure forms the most stable and firm bond with hydrogen ions, has strong wear resistance and impact resistance, and has high fading resistance and ultraviolet resistance in extremely harsh and harsh environments.

It has high impact strength, abrasion resistance, and is the strongest fluorine plastic. It can be used for a long time in the temperature range of -62℃ -150 ℃, with high heat resistance and outstanding weather aging resistance.

The C-F bond in the carbon-fluorine molecular chain has a large polar distance, and it is a polymer with extremely high polarity and excellent dielectric properties.These excellent properties are used in automotive, aviation, robot wire and cable insulation materials and transmission of special liquid media pipeline lining coatings.

3. Market size

In recent years, PVDF has occupied a pivotal position in the field of material application, the global production capacity of about 140,000 tons, according to statistics, only high-end lithium battery materials, its market space is about 24.9 billion (RMB).Under the rapid development of new energy such as lithium battery and photovoltaic, the supply bottleneck of high-performance PVDF has risen sharply, and the price has also driven the industry's capacity expansion and variety structure adjustment.PVDF's production capacity in China is growing rapidly, as of the end of 2022, PVDF's existing production capacity of 115,500 tons/year, according to the existing capacity planning of PVDF manufacturers, it is expected that by the end of 2023, PVDF production capacity is expected to increase to 205,500 tons/year.

Downstream applications of PVDF mainly include injection molding (21.1%), weather-resistant coating (36.9%), photovoltaic backplane film (8.1%), and lithium battery (9.9%). Among them, PVDF for lithium batteries has become the fastest growing area of PVDF downstream applications, and the share of the lithium market has increased significantly from less than 10% two years ago to 19.90%, because PVDF is one of the indispensable key materials in power automotive batteries and 3C electronic batteries.The rapid development of new energy vehicles has promoted the rapid growth of PVDF demand.

4. Future outlook

The application prospect of PVDF and its basic materials is very broad, in line with market demand and policy orientation, and is one of the industries to be encouraged to develop.Considering the large number of papers currently working on PVDF, and their number is still increasing, it is safe to say that the research on attractive materials such as PVDF will continue to flourish in the future.A large part of the current research is devoted to using PVDF as a separator for lithium-ion batteries (LiBs).Considering the inert reaction, thermal stability, good mechanical strength and processability of PVDF, PVDF is well suited for this use.Another notable potential application of PVDF is in medical devices.For example, there is currently no ideal material for anterior abdominal wall plastic surgery, and the application has extremely demanding requirements for material biocompatibility, material strength, and service life, which makes finding the best polymer for anterior abdominal wall surgical reconstruction a difficult task.PVDF is one of the most potential materials in this regard, there are already research institutions PVDF prepared into medical devices, widely used in the manufacture of suture materials, and polypropylene, PVDF does not contain stabilizers and plasticizers, does not hydrolysis under the action of tissue liquid, in the implantation process has greater biocompatibility and resistance to the role of environmental factors in the body.Therefore, PVDF is closely related to human life and health, clothing, food, housing and transportation, and may play a more important role in the future.

5. Application examples

This article gives a typical case to illustrate why PVDF has irreplaceable importance in specific applications.Polyvinylidene fluoride (PVDF) is a semi-crystalline fluoropolymer, because of its excellent mechanical strength, chemical stability, electrochemical stability, thermal stability and other properties, has been paid much attention.With the rapid development of lithium battery technology and market, PVDF has shown a rapid growth trend in the lithium battery industry, with an annual demand growth rate of more than 20%.

PVDF is mainly used in the lithium battery industry as a binder, diaphragm and diaphragm coating.The commercial lithium battery electrode is generally composed of a fluid collector, an active substance, a conductive agent and a binder.In lithium-ion batteries, the binder is generally a polymer with good stability, and the mass is relatively low in the entire battery (about 1%-10% of the electrode mass).In addition, the binder is an inactive material in lithium-ion batteries, and although it does not provide capacity for the battery, it has a significant impact on the performance of lithium-ion batteries.PVDF is the most representative oil-based binder and has long been commercialized.At present, PVDF accounts for more than 95% of the positive binder.

Binder generally exists in the lithium-ion battery electrode, the main role includes the following two points: (1) homogenization: in the preparation of the electrode, the binder is first dissolved in the appropriate solvent to form a colloidal substance, and then ball ground homogenization with the conductive agent and the active material to ensure the uniform and stable dispersion of the conductive agent and the active material;(2) Bonding: the active substance, conductive carbon and fluid collector do not interact with each other, and the polymer binder binds them to each other to prevent the internal particles from falling off during processing and normal operation of the electrode.

Lithium-ion battery electrodes are prepared by coating method, the coating is thin, and non-aqueous carbonates (such as propylene carbonate, ethylene carbonate, etc.) are used as electrolyte solvents, so the binder used has special requirements, mainly including the following points:

(1) It can maintain thermal stability when heated to the condition during drying and dewatering;

(2) can be wet by organic electrolyte;

(3) Good processing performance;

(4) not easy to burn;

(5) Stability of, etc., and by-products, etc., in the electrolyte;

(6) has relatively high electron ion conductivity;

(7) Low consumption and low price.

Lithium-ion batteries work at high voltage, requiring good electrochemical stability of the binder used, and the decomposition voltage is above 4.5V.At the use temperature, in order to ensure that the electrode coating does not fall off and does not drop powder for a long time, it is necessary to resist the penetration of polar organic solvent electrolyte, do not dissolve and less swelling. At the same time, it is also required that all binders can be well dissolved in a certain organic solvent for mixing and coating processing. Good bonding properties and certain softness of the metal are necessary to ensure the normal production and long life of the battery, especially for square batteries, it is crucial to prevent the pole sheet from falling off during winding and use. The properties of the binder, such as adhesion, flexibility, alkali resistance, hydrophilicity, etc., directly affect the performance of the battery.By adding the best amount of binder, larger capacity, longer cycle life and lower internal resistance can be obtained, which promotes the cycle performance of the battery, the rapid charging and discharging ability and the reduction of the internal pressure of the battery.

At present, the main binders that can be used are polyvinylidene fluoride, polytetrafluoroethylene (PTFE), polytetrafluoroethylene hexafluoropropylene copolymer, polyacrylonitrile, polyacrylic acid, polyimide, SBR, CMC and so on.Among them, polytetrafluoroethylene mainly has the problem of low peeling strength, and polytetrafluoroethylene hexafluoropropylene copolymer also has the problem of low peeling strength.Water polymer, there is a positive electrode material is particularly afraid of water, and it is not easy to dry and other problems, and polyacrylonitrile and polyacrylic acid there is a hard material problem, once toughness modification, there will be no peeling strength. Polyimide is too expensive.SBR and CMC have poor high voltage resistance and cannot be used in the positive electrode of the battery.PVDF can meet all the requirements for the use of positive battery binder, and the current price is suitable.In 2022, the price of PVDF soared, once reaching 400,000-500,000 / ton, and the current price of PVDF is less than 100,000 / ton.At that time, PVDF such a high price environment, there is still no substitute for PVDF binder, its use as a positive electrode binder, irreplaceability is extremely high, it is difficult to appear substitutes in the short term.

6. Analysis of the consequences of the implementation of the Act

If the EU legislature insists on banning PVDF materials, the following consequences can be expected.

(1) The fluorine chemical industry will inevitably be affected and the industrial structure will be transformed. It is foreseeable that the potential problems caused by PFASs can be solved quickly after the implementation of the Act, but the impact on industrial economic development will be long-term, and it is difficult to simply predict. It is suggested that a comprehensive economic impact assessment should be made before the implementation of the Act;

(2) PVDF has a wide range of applications in many fields, and the proposed restriction on PVDF will also greatly limit the development of the fields such as biomedicine and energy, which will have a negative impact on social progress.In order to ensure the good development and progress of human society and economy, the bill needs to exclude PVDF from the scope of PFAS.

7. Conclusion

To sum up, some of the contents contained in the bill are unreasonable and go against the original intention of the bill, especially the PVDF polymer plays an important role in many uses, so it should not be banned, and we hope that PVDF can be exempted.

Section V: Non-public Attached Information (Classified Information)

slightly