

PFAS

**Application for an exemption request for
the draft PFAS**

:

Product name: Fluorinated material

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**Submission party: Quzhou Ruifu
Chemical Co., LTD**

:2023 8 23

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23,2023

限制PFAS对氟化学品的影响

Report on the impact of limiting PFAS on fluorine chemicals

2023年2月7日，欧洲化学品管理局(ECHA)发布了一项限制生产及使用的per-and polyfluoroalkyl substances(“PFAS”)的提案。该提案旨在限制PFAS的生产和使用，ECHA表示，该提案将限制10000种PFAS物质，包括氢氟碳化物(HFCs)和氢氟烯烃(HFOs)。

PFAS是一类非天然有机化合物，主要由碳原子和氟原子组成。PFAS因其独特的性能而被广泛使用。PFAS主要应用于航空航天和国防、汽车、航空、纺织、皮革和服装、建筑和家居产品、电子、消防、食品加工和医疗用品。

On 7 February 2023, the European Chemicals Agency (ECHA) published a restriction proposal to restrict the production and use of perfluoroalkyl and polyfluoroalkyl compounds (per-and polyfluoroalkyl substances, "PFAS"). The proposal, jointly compiled and submitted by Denmark, Germany, the Netherlands, Norway and Sweden, aims to reduce PFAS emissions in the environment. According to details published on the ECHA website, more than 10,000 PFAS substances will be included in the proposal limit, including hydrogen fluorine for car air conditioners Carbide (HFCs) and hydrofluoroolefin (HFOs) refrigerants. If the proposal is passed, it will have a huge impact on the relevant industries at home and abroad.

PFAS, is a series of non-natural synthetic organic compounds, mainly composed of carbon atoms and fluorine atoms. PFAS are widely used because of their unique desirable properties. The areas using PFAS mainly include aerospace and defense, automotive, aviation, textiles, leather and clothing, construction and household products, electronics, fire protection, food processing and medical supplies.

“双碳”目标下，我国氟化工行业面临转型升级的压力。2022年，我国氟化工行业总产值为688.7亿元，同比增长93.4%；其中，PFAS产量为61.2%。

PFAS主要应用于：

1. New energy vehicles, lithium batteries

The implementation of the "double-carbon" strategy, as well as in order to reduce oil dependence and promote the upgrading of the automobile industry structure, the country vigorously promotes new energy vehicles, in recent years, the output of new energy vehicles is also growing growth. In 2022, the sales volume of new

energy vehicles in China reached 6.887 million units, up 93.4% year on year, accounting for 61.2% of the global sales volume.

The main applications of PFAS in the automotive field are:

In modern lithium-ion batteries, PFAS has two main applications:

1. PVDF (polyvinylidene difluoride) is used as a binder coated with metal oxide cathode. PVDF has excellent chemical stability, weather resistance, adhesion, widely used in fluorocarbon coating, injection molding, lithium battery, photovoltaic backplane and water treatment and other fields. Among them, lithium battery is the fastest developing downstream field, and PVDF mainly serves as a cathode binder. With the rapid development of new energy vehicles, energy storage and consumer electronics, the demand continues to increase. At the same time, PVDF, as the main photovoltaic backplane film, benefits from the rapid growth of the overall installed photovoltaic capacity, and the demand also increases steadily. It is estimated that the total demand for PVDF in 2021 reaches 60,000 tons, including reference. In 2021, the average price of each category is 195,000 yuan / ton, corresponding to the market size of 11.7 billion yuan; by 2025, the total demand of PVDF products will reach 134,000 tons, corresponding to the market size of 26.1 billion yuan, with an average annual growth rate of 22%. PVDF has a wide range of applications, and the demand will grow rapidly in the future.

2. Fluoroethylene carbonate (FEC) is used as an electrolyte additive. The demand for FEC is growing rapidly. In 2021, the average price of each category is 195,000 yuan / ton, corresponding to the market size of 11.7 billion yuan; by 2025, the total demand of PVDF products will reach 134,000 tons, corresponding to the market size of 26.1 billion yuan, with an average annual growth rate of 22%. PVDF has a wide range of applications, and the demand will grow rapidly in the future.

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2. Fluorinated organic additives in the electrolyte are used to improve the battery life. For example, fluorobenzene and fluoroethylene carbonate (FEC) form a protective layer that prevents the material in the anode from reacting with the electrolyte. The solution is one of the four core raw materials of lithium battery, accounting for 5-10% of the production cost of lithium battery. At the beginning of the development of lithium battery industry, China's electrolyte is mainly dependent on imports. In 2002, domestic lithium battery electrolyte began to develop, rapidly rising to gradually replace imported products, at present, China's electrolyte has fully realized domestic replacement; in 2022, the global production of lithium battery electrolyte is 1,017,800 tons, a year-on-year increase of 8 0.7%, of which the market output in China was 867,500 tons, up 78.4% year on year, accounting for 85% of the global output. In 2022, the market size of China's electrolyte was 69.500 billion yuan, with a year-on-year growth of 98.67%. It is expected that in 2025, the global electrolyte market size will reach 133.31 billion yuan, and the market size of China's electrolyte will reach 114.02 billion yuan. Under the rapid expansion of lithium battery production, China's electrolyte additives shipments increased year by year, and the growth rate increased significantly. In 2022, the shipments will reach 68,000 tons, the growth rate is still maintained at More than 90%. At present, with the rise of China's lithium battery industry, China's electrolyte additives not only achieve self-sufficiency, but also a large number of exports to overseas markets. Subinyl carbonate (VC) and fluorinated vinyl carbonate (FEC) are the mainstream electrolyte additives in the current market, and the market size will further grow to 6.6 billion yuan in 2022. In the future, the growth rate of China's electrolyte additive market will be more than 20%. It is expected that by 2024, the market size of VC / FEC additives will exceed 10 billion yuan, and will exceed 16 billion yuan in 2025.

[illegible]

The substances used in fuel cells must be very stable in terms of chemical, mechanical, and thermal stability, so they are made from polytetrafluoroethylene (PTFE), FEP, or fluoroelastomer

(fluorine rubber, FKM). PFAS has many applications in fuel cells. They are found in: polymer electrolyte membrane (PEM), electrode, gas diffusion layer, gas, water and air channel sealant, coolant circuit, etc. Although some components of the proton exchange membrane (PEM) fuel cell are made of powerful existing materials, the technological prospects will change in many ways in the coming years. In addition to demand growth, new trends, and participation The PEM fuel cell-related materials market is expected to be valued at more than \$7 billion by 2030.

2.5G

2. 5G, semiconductor, chip

PFAS is used in various applications, including in the semiconductor industry. PFAS is used in the production of liquid crystals and semiconductors. The coolant required for semiconductor manufacturing (electronic grade fluoride solution) belongs to PFAS products, because it is widely used in semiconductors because of its colorless, tasteless, low viscosity, nonconductive, nonflammable, noncorrosive, high safety, and very stable physical and chemical properties. Therstant static cooling of etching equipment, ion injection equipment, and chemical vapor deposition (CVD) equipment. For semiconductors, PFAS is used in the central lithography process, but PFAS does not appear in the final product.

SEMI data shows that the global semiconductor materials industry shows a steady upward trend, and semiconductor materials are an important link in the semiconductor industry chain. According to SEMI data, the market size of the global semiconductor materials industry in 2020 was 555 billion, and in 2021 it was 643 billion, an increase of 15.86%. 5G is expected to be a major driver of growth in the semiconductor materials industry.

In power electronics, PFAS is used to use oil in contact systems for diaphragm, seals and shell coatings, and safety-critical sensor applications, which is essential for electric vehicle applications and autonomous connected driving. PFAS is also widely used in other electronic devices of electric vehicles, among which the most represented is the production of liquid crystals and semiconductors. The coolant required for semiconductor manufacturing (electronic grade fluoride solution) belongs to PFAS products, because it is widely used in semiconductors because of its colorless, tasteless, low viscosity, nonconductive, nonflammable, noncorrosive, high safety, and very stable physical and chemical properties. Therstant static cooling of etching equipment, ion injection equipment, and chemical vapor deposition (CVD) equipment. For semiconductors, PFAS is used in the central lithography process, but PFAS does not appear in the final product.

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industry was \$55.5 billion in 2020 and grew to \$64.3 billion in 2021, up 15.86% year on year. In the past two years, benefiting from the rapid development of 5G and new energy industry, the market demand of China's semiconductor industry has been greatly increased, and the market size of semiconductor materials has risen rapidly.

2021 4630.02 28.2% 83.29% 434.04 303.37 191.49 7.81% 5.46% 3.44% 2015-2021 15% 2021 10458.3 18.2% PFAS

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From the perspective of the semiconductor segmentation field, the integrated circuit has always been the main segmentation field of the semiconductor industry. In 2021, the global IC market reached \$463.002 billion, with a year-on-year growth of 28.2%, accounting for 83.29% of the global semiconductor market; the global optoelectronic devices, discrete devices and sensors were \$434.04, 303.37 and \$19.149 billion, accounting for 7.81%, 5.46% and 3.44% respectively. China's integrated circuit market scale is growing rapidly. According to the China Semiconductor Industry Association, China in 2015-2021 The growth rate of integrated circuit sales is basically maintained above 15%, reaching 1,045.83 billion yuan in 2021, with a year-on-year growth of 18.2%. The domestic semiconductor market is developing rapidly, and the production capacity under construction and planned in the future provides a broad market space for special gas. With the rapid development of information technology and intelligent technology, semiconductor chips and device products have been widely used in semiconductor lighting, new-generation mobile communication, smart grid, new energy vehicles, consumer electronics and other fields, and the market scale of integrated circuits has achieved rapid growth. Role of PFAS in the semiconductor industry:

One of the most common uses of PFAS in the semiconductor industry is the lithography process. During the lithography process,

a thin layer of photoresist is applied, and the silicon wafer is then exposed to UV light through a photomask to transfer the pattern to the wafer. The photoresist acts as a mask to protect portions of wafers that should not be etched or deposited when selectively removed or modified in the exposed area. PFAS was added to the photoresist to improve its adhesion to the silicon wafer, increase its durability, and enhance its resistance to irritating chemicals and high temperatures.

PFAS 在光刻胶中起着至关重要的作用，它提高了光刻胶对硅片的附着力，增强了其耐用性，并提高了其对刺激性化学物质和高温的抵抗力。

PFAS 在光刻胶中的应用，使其能够在硅片表面形成一层保护膜，防止光刻胶在曝光过程中被剥离，从而提高光刻的精度和良率。

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In addition to its use in lithography, PFAS is also critical in producing other semiconductor components (e. g., interconnect and packaging materials). PFAS-based materials help create low-k dielectrics and insulators, help reduce the capacitance between the wires in the chip, speed up processing and reduce power consumption. PFAS is also used in packaging materials to improve thermal stability and moisture resistance.

In addition to its applications in chip manufacturing, PFAS is also essential for semiconductor manufacturing equipment and factory infrastructure. Their superior properties, such as heat resistance and chemical inertia, make them available for equipment components (pipes, washers, containers, filters, etc.) and lubrication (e. g. various oils and oils).

Restricting PFAS cannot produce the finished product. The refrigerant used in the dry etching unit becomes half, resulting in the inability to produce all motor products, including the car.

PFAS

3. Photovoltaic, energy storage

在光伏和储能领域，PVF和PVDF是常用的材料。PVDF具有较高的热稳定性和化学稳定性，广泛应用于光伏电池的封装材料和储能设备的隔膜材料。PVDF的介电常数在30左右，而PVF的介电常数在15左右。PVDF的机械强度较高，能够承受较大的应力。PVDF的耐热性较好，能够在150-220℃的温度下长期使用。PVDF的耐腐蚀性较强，能够抵抗各种化学物质的侵蚀。PVDF的导电性较差，需要通过掺杂来提高其导电性。PVDF的成型工艺较为复杂，需要通过注塑或挤出成型。PVDF的回收难度较大，需要通过专业的回收机构进行回收。

In the global background of advocating energy conservation, environmental protection and low-carbon economy, it has become an inevitable trend for new energy represented by solar energy to replace traditional fossil energy. At present, the back film materials of solar cells mainly include polyvinyl fluoride (PVF) film, polyvinylidene fluoride (PVDF) film, tetrafluoroethylene-hexafluoropropylene-vinylidene copolymer (THV) film, trifluorovinyl chloride-ethylene copolymer (ECTFE), etc. As the main PVDF cell backplane weather resistance material of photovoltaic modules, due to its high fluorine content, its weather resistance, barrier resistance and processing adaptability are better than other materials. PVDF and other fluorine material films are available in the photovoltaic market. The demand is nearly 3 billion cubic meters, and the electronic grade hydrofluoric acid cleaning consumes about 150,000 tons. Under the "carbon peak, carbon neutral" target, during the period of "difference" our country photovoltaic market construction peak, is expected to stabilize new growth above 30%, with the 2023 industry chain price downward cycle, cost reduction, installed speed, expected domestic average annual photovoltaic installed in 150~220 GW, output value of 3000 ~ 500 billion yuan market, is expected to further accelerate the energy transformation in China, provide broad market space for fluorine materials.

Building Integrated Photovoltaic, BIPV 2025 年 BIPV 46GW “十四五”期间 121GW 20-25 年 BIPV 101%

Photovoltaic Building Integration (Building Integrated Photovoltaic, BIPV) is a kind of distributed photovoltaic power generation system, which is the technology of integrating photovoltaic modules into the building. At present, it is mainly used in public buildings (only organized towns), rural houses, factory and warehouse three categories of new buildings. In 2025, the potential market for BIPV is expected to reach about 46GW, with a total of 121GW during the 14th Five-Year Plan period. The BIPV market is expected to grow rapidly in 20-25, with a compound growth rate of 101%.

Fluoride-containing fine chemicals and pharmaceuticals and pesticides

PFAS 2020 年 30 万吨/年 15 万吨/年 15 万吨/年

fluorine-containing fine chemicals 45%, fluorine-containing pharmaceuticals 27%, fluorine-containing pesticides 12%

fluorine-containing fine chemicals, fluorine-containing pharmaceuticals, fluorine-containing pesticides, fluorine-containing intermediates, fluorine-containing surfactants, fluorine-containing functional preparations, fluorine-containing medical pesticides, fluorine-containing dye liquid crystal and its intermediates, fluorine surfactants and functional preparations. At present, the total number of intermediates used in fluorine-containing medicine and pesticides is about 100,000 tons. Among

fluorine-containing fine chemicals, 30% are based on fluorine-containing intermediates. In 2019, the FDA approved 48 marketing applications for new drugs, with 11 drug molecules containing fluorine. Global annual sales of fluorinated drugs are about \$40 billion. Of the top 200 drugs sold worldwide, 29 contain fluorine, with a total sales volume of \$32 billion. Fluorinated pharmaceutical intermediates are estimated at \$4 billion

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PFAS in fine chemicals and pharmaceutical pesticides:

Aliphatic and heterocyclic fluorinated fine chemicals production, are both PFAS substances. In recent years, with the continuous expansion of the development and application of new fluorine fine chemical products, the global total production capacity of fluorine-containing fine chemicals will reach 30 0,000 tons / year in 2020, and the total output will reach more than 15 0,000 tons, with an annual growth of more than 15%. In developed countries, the output value of fine chemicals in fluorine chemical industry is as high as 45%; the output value of fine chemicals in fluorine accounts for 27%, which has great room for development.

Fluorinated intermediates mainly include aromatic fluoride and aliphatic fluoride, which is given priority to with aromatic fluoride, focus on the development of chronic diseases, severe diseases and for major outbreaks of public health pressure of fluorine pharmaceutical products, such as diabetes, cardiovascular disease, AIDS, cancer, respiratory tract and digestive tract, the development of low toxicity pesticides required fluoride intermediates.

In medicine, 30 percent of new drugs are based on fluorine-containing chemicals. In 2019, the FDA approved 48 marketing applications for new drugs, with 11 drug molecules containing fluorine. Global annual sales of fluorinated drugs are about \$40 billion. Of the top 200 drugs sold worldwide, 29 contain fluorine, with a total sales volume of \$32 billion. Fluorinated pharmaceutical intermediates are estimated at \$4 billion

Fluorinated medical pesticide dye liquid crystal and its intermediates, fluorine surfactants and functional preparations. At present, the total number of intermediates used in fluorine-containing medicine and pesticides is about 100,000 tons. Among

the important pesticide products developed in recent years, more than 30% of the products have fluorine-containing structure. At present, the fluorine-containing three-prevention finishing agent is mainly used in the surface treatment of all kinds of textiles, fabrics and leather, and the production of the fluorine-containing fabric finishing agent and its corresponding monomer has been mainly produced in China.

Fluorinated pesticides have the advantages of high activity, low toxicity and environmental friendliness, which has become one of the key development directions of pesticides in the world. At present, there are hundreds of fluorine-containing pesticides, fungicides, herbicides and plant growth regulators. In the past decade, the fluorine-containing pesticides have developed rapidly in the world. At present, there are more than 1300 pesticide varieties in the world, with fluorine-containing pesticides accounting for about 12%, while herbicides accounting for 45%, 33%, 15% and 7%.

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1. Global and Chinese fluorine chemical output value
fluorine chemical products include a complete fluorine chemical industry chain including inorganic fluoride, fluorocarbon chemicals, fluoropolymers, fluorine fine chemicals, fluorine material processing, etc. According to statistics, in 2022, the global total production capacity of fluorine chemical products will be 8.9 million tons, and the global output value will be about 120 billion US dollars (840 billion yuan). Among them, there are more than 1000 Chinese enterprises, with annual sales of more than 500 billion yuan, the production capacity of all kinds of new fluorine materials exceeds 6 million tons, the output is stable at more than 3.7 million tons, and the downstream demand fluctuates around 3.5 million tons. China's production capacity and consumption both account for more than 60% of the world, The industry self-sufficiency rate is about 105%.

sum up:

1. Global and Chinese fluorine chemical output value
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2. Global and Chinese pesticide sales
In 2022, the global sales of pesticides reached us \$49 billion (343 billion yuan), with a year-on-year growth of 3.4%. It is

expected that the annual growth rate will be 2-4% in the next five years. The output value of fluorine-containing pesticides accounts for 16% of all pesticides, and the output value is about 7.84 billion US dollars (54.88 billion yuan), and the output value of fluorine-containing pesticides in China is 12 billion yuan. The global output value of fluorinated pesticide intermediates is 3.5 billion US dollars (24.5 billion yuan), and the output value of fluorinated pesticide intermediates in China is 8 billion yuan.

[illegible]

Global pharmaceutical sales of fluorine-containing pharmaceutical and chemical products and finished products reached us \$1.4 trillion (9.8 trillion yuan), with a compound growth rate of 5.5% in the past five years. Fluorinated medicine accounts for about 22% of small molecule medicine. The global annual sales of fluorine-containing medicine exceeds 40 billion US dollars (280 billion yuan), and the output value of Chinese fluorine-containing medicine is 56 billion yuan. The global fluorinated pharmaceutical intermediates are estimated to be us \$4 billion (28 billion yuan), and the output value of fluorinated pharmaceutical intermediates in China is 8 billion yuan. The global sales volume of new materials containing fluorine has reached 14 billion US dollars (98 billion yuan), made in China The value is about 54 billion yuan, with a compound growth rate of 10-15% in the past 5 years. The market demand for new energy and new materials is booming, driving new fluorine materials into the fast track of industrial development. In 2022, the global output value of finished products containing new materials will be about 32 billion US dollars (224 billion yuan), and the output value of new materials in China will be about 120 billion yuan.

2010 32

The development plan of China's strategic emerging industries began in 2010, issued no. 32. Involving eight major industries and three stages of development goals. The eight industries are energy conservation and environmental protection, new-generation information technology, biology, high-end equipment manufacturing, new energy, new materials, new energy vehicles, and digital creativity.

PFAS PBT PFAS
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PFAS

環境省 PPP・BP ・ MP 環境省 PFAS 環境省
PFAS 環境省 PFAA 環境省

PFAS involves tens of thousands of fluorine-containing chemicals, and its properties, PBT characteristics and environmental safety risks are also very different. It is obviously unreasonable to restrict all PFAS by using a single group. Due to the large number of PFAS involved, current studies on its PBT performance are far from covering the entire PFAS. The PFAS proposal is not clear. Fluorinated chemicals, especially fluorine materials, are applied to some key and special application scenarios, such as semiconductor, military, aerospace, etc., and are often the only available materials, which are often less well known or even available Confidentiality requirement, will result in no inconsistency of exemption requirement for active substance.

EU proposal will belong to the PPP, BP and MP active substances excluded from the PFAS limit, but the synthesis of these active substances generally need to belong to the synthesis of PFAS block synthesis, according to the proposal, the synthetic block should belong to the precursor of PFAA limited, the actual is indirectly limit the active substances, contradictory with the intention of the proposal.

□□□□□

1 PFAS

PFOS PFOA PBT

2 PFAS

3 PFAS

propose:

1. The coverage of PFAS is too extensive, and the concept of full coverage seriously affects the safety of product supply in China's industrial chains, and limits China's high-quality development and double-carbon goals

It is suggested to refer to the restriction proposals of PFOS and PFOA, and subject them with the nature of PBT;

Raw materials related to China's strategic emerging industries, without clear alternative products, the PFAS substances used are exempted;

Systematically carry out PFAS material research, establish professional response departments, and conduct multi-latitude communication with relevant international organizations.