

Appeal for Exemption of Polytetrafluoroethylene Resin based Copper Clad Laminates (PTFE CCL) from REACH PFAS Restriction

Subject: Application for Exemption of PTFE Copper Clad Laminate

Applicant:

**China Electronics Materials Industry Association/ Copper Clad Laminate
Association**

Submit Date: August 30, 2023

Reasons:

- 1. PTFE is considered as “Polymers of Low Concern” (PLC). It is non-toxic and non-bioaccumulative. PTFE should be classified separately from broad PFAS substances and should be permanently exempted from the PFAS restriction.**
- 2. PTFE based copper clad laminate is environmentally friendly during production and its manufacturing process is controllable. PTFE doesn't create negative impact on the environment.**

3. PTFE copper clad laminate offers excellent electrical properties and reliability; thus, it is an indispensable high-performance laminate material of choice in the global electronic circuit industry.

The Copper Clad Laminate Material Association, a Division of China Electronics Materials Industry Association, has been adhering to the concept of sustainable and healthy development, and has made continuous efforts for industry enterprises to comply with International and Chinese laws and regulations. We support the European Union's continuous exploration and various attempts to reduce the risk of hazardous substances, and deeply understand the genuine intent of this proposal to better protect the environment.

However, from a comprehensive perspective, the restriction of PTFE from the "Proposal to Add PFAS to the REACH Restriction Chapter" will have a huge impact on many products that have long been used in daily life. Considering the broad application of PTFE in the electronics industry and in the printed circuit board industry, especially in the PTFE copper clad laminate sub-industry, we believe that the proposed restriction of PTFE is excessive and scientifically unreasonable. Hence, we would like to make the following comments during this public consultation period to the European Chemicals Agency:

1. PTFE is of low concern, non-toxic, non-bioaccumulative, and should be classified separately and exempted permanently.

Public data has showed that fluoropolymers have thermal, chemical, photochemical, hydrolytic and biological stability. Among them, PTFE is a complete linear polymer with a molecular weight of more than 3 million. PTFE has high molecular weight and narrow molecular weight distribution and it does not contain oligomers and organic and inorganic leachables. Polytetrafluoroethylene (PTFE) has been extensively tested to comply with US and EU food contact and global medical device regulations (for example, by FDA in the US, CFDA in China, MFDS in Korea and PMDA in Japan), including ISO 10993 biocompatibility testing and preclinical animal testing. Toxicological studies of PTFE have shown that PTFE does not have acute or subchronic systemic toxicity and other genotoxicities, etc. Overall, the fluoropolymer category meets the PLC standard, i.e. "low concern polymer". From this point of view, at the very least, PTFE should be regarded as distinctly different from other types of PFAS, that is, PTFE is of low concern, non-toxic and non-bioaccumulative. PTFE should be separated from other PFAS for hazard assessment or regulatory purposes.

2. PTFE copper clad laminate is environmentally friendly during production and processing, and its fabrication process is

controllable and will not affect the environment.

PTFE copper clad laminate is mainly composed of copper foil, PTFE resin, glass cloth and fillers, and is completed through related manufacturing processes, including varnish mixing, impregnation and lamination.

2.1 PTFE major raw material illustration:

Glass fiber cloth is to draw glass into extremely fine glass filament, and the glass filament has good softness. The glass filament is spun into yarn, and then woven into fiberglass cloth and coated with coupling agent to have better wettability with varnish.

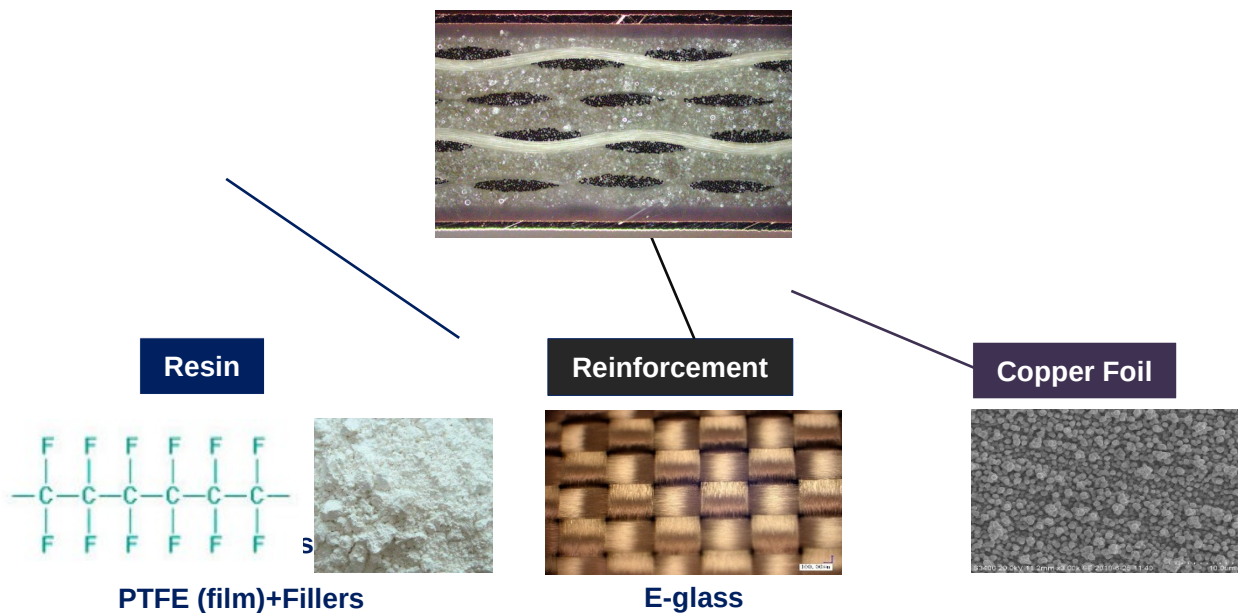
The main component of copper foil is copper, typically over 99.9%. This high-purity copper foil ensures excellent electrical conductivity and thermal conductivity.

PTFE dispersion is mainly a resin formed by polytetrafluoroethylene (PTFE) uniformly dispersed in water.

Since 2009, perfluorooctane sulfonic acid and its derivatives (PFOS) have been listed under the Stockholm Convention to eliminate their use. PFOS has been restricted in the EU for more than 10 years under the EU's Persistent Organic Pollutants (POPs) Regulation. In addition, the Stockholm Convention regulates the global elimination of perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds. Since July 4, 2020, PFOA has been banned under the POPs regulations.

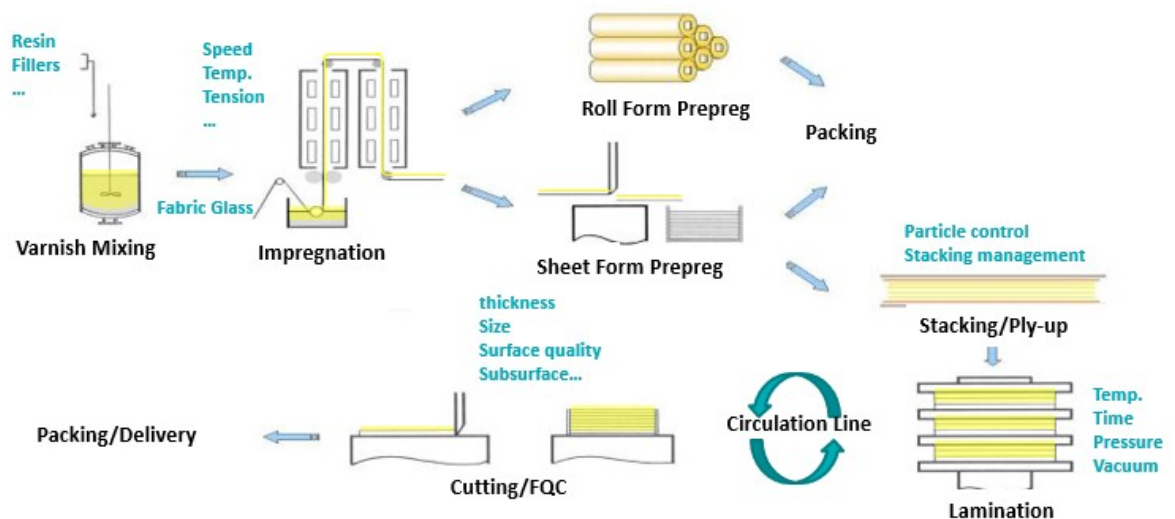
Therefore, the current PTFE emulsion basically no longer uses

perfluorinated emulsifiers containing trace amounts, but switches to fluorine-free emulsifiers.



2.2 PTFE CCL Production Flow

◆ $R_z: 2.5 \sim 4 \mu m$ E-Glass
RTF $(R_z: 2.5 \sim 4 \mu m)$ E-Glass



Ceramic filler and water are added to the PTFE dispersion emulsion to prepare the varnish, and the glass fiber cloth is used as the reinforcement for multiple impregnation of the varnish and baked at high temperature to obtain the prepreg, and then the prepreg and

copper foil are stacked and pressed at high temperature to obtain the PTFE copper clad laminate. After impregnation, high-temperature baking and pressing, the water and emulsifier in the PTFE dispersion are completely evaporated, and the evaporated material is treated by professional environmental protection equipment (RTO) to comply with relevant environmental regulations and emission standards. We strictly comply with the EU's Persistent Organic Pollutants (POPs) regulations.

PTFE copper clad laminate only contains PTFE resin, ceramic inorganic filler, inorganic glass fiber cloth and copper foil. PTFE itself is a non-toxic polymer material. PTFE copper clad laminate offers low loss tangent, stable dielectric constant, high thermal conductivity, high chemical stability, low water absorption and many other advantages.

The vice-chairman member of our association "Shengyi Technology" has arranged PFAS106 test at SGS for the typical products of PTFE copper clad laminate. According to the current list of PFAS106 test substances which SGS can detect, the corresponding test results of PTFE copper clad laminates are ND. Attached please find a copy of SGS test report on a Shengyi's PTFE based CCL.

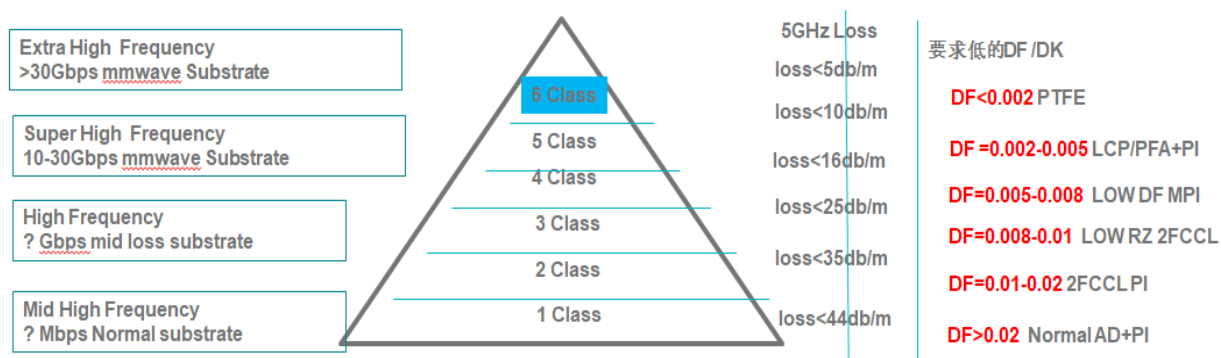
3. PTFE copper clad laminate has excellent electrical properties and

reliability, and is an indispensable high-performance dielectric material in the global electronic circuit industry.

PTFE copper clad laminates are mainly used to be further processed into high frequency circuit boards, and this kind of circuit boards are widely used in various RF devices, which is a critical electronic component in many electronic communication products.

The excellent electrical properties of PTFE copper clad laminate are determined by the molecular structure of its main resin, and the electronegative fluorine atoms tightly surround the carbon-carbon backbone. In the theory of electromagnetic wave transmission, the lower the dielectric constant of the insulating medium, the faster the transmission speed of the signal; The smaller the dielectric loss, the more stable the dielectric properties, and the better signal integrity of transmission line. In general, circuits such as radio frequency (RF) that operate at frequencies above 1GHz can be defined as high-frequency circuits. Since its birth, PTFE materials have been used in the high-frequency communication fields. From the onset the 2G era, until the 5G base station antenna that we are familiar with, PTFE based copper clad laminate has offered excellent electrical properties to be applied in wide range of applications, such as radar, wireless broadband, communication products, satellite navigation, autonomous driving, various RF devices

and other fields. Market demand of PTFE laminate has increased year after year.



Compared with non-PTFE laminate, PTFE type has the following properties that cannot be replaced:

1. Lowest Dk. The Dk of PTFE is 2.1, and other resins such as polyhydrocarbon is 2.2-2.6; polyphenylene ether resin is 2.4-2.6.
2. Minimum Df. The theoretical Df of PTFE is 0.00009, which is currently the lowest of all resin systems. Polycarbon hydrogen is 0.001-0.005, polyphenylene ether resin is 0.0007-0.003.
3. The change of dielectric constant and dielectric loss property over temperature, humidity and frequency is minimal.
4. Excellent low water absorption and heat resistance. PTFE is non-polar and basically it does not absorb water. Additionally, PTFE has excellent heat resistance due to its extremely high molecular weight and excellent heat resistance. It can be used for a long period of time even at 260°C, which is impossible with other resin systems.

Table 1 and Table 2 below listed pros and cons of different resin systems and key CCL components.

Table 1 PTFE and other resin Dk and Df comparison

No.	Primary resin system of laminate	Dk	Df
1	PTFE	2.0-2.1	0.00009
2	Polyhydrocarbons	2.2-2.6	0.001-0.005
3	PPO/PPE	2.4-2.6	0.0007-0.003
4	SiO ₂	3.8	0.0001-0.0003
5	Al ₂ O ₃	8-9	0.0003-0.001
6	TiO ₂	80-100	0.0001-0.0003
7	E-Glass	4.5-6.6	0.001-0.003

Table 2 PTFE and 2 other major resin system comparison

Resin	PTFE	Ceramic filled hydrocarbon	PPO/PPE
Advantages	Very low dielectric constant and dielectric loss angle, and very small changes with temperature, humidity and frequency. High heat resistance & maximum operating temperature index; Flame retardant.	Lower dielectric constant and dielectric loss angle; Thermosetting system, strong rigidity.	Lower dielectric constant and dielectric loss angle; Thermosetting system, strong rigidity Copper foil peeling strength is better
Disadvantage	thermoplastic materials, insufficient rigidity	The peeling strength of copper foil is low.	Thermal oxygen aging is weaker than PTFE, but

s		High curing temperature. Poor heat and oxygen aging resistance.	better than hydrocarbon.
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From electrical property and performance perspective, PTFE copper clad laminate sits at the top of the pyramid of all laminate material. In a long run, some end customers will be able to adjust their designs by reducing the electrical performance requirements so they can make alternative resin system to work. However, from the electrical performance point of view, alternative solutions can't completely replace the existing PTFE copper clad laminate materials. In fact, it would result in high overall cost.

If the sale and usage of PTFE copper clad laminates in the EU market are restricted, it would adversely limit the dielectric material choice for European communications companies to achieve the ultimate product performance. Thus It might weaken the competitiveness of European companies in the global communications market.

In summary, the reasons for applying for exemption are as follows:

1. We would like to get clarification whether PTFE is part of controlled substance under the "Proposal to Add PFAS to the REACH Restriction Chapter".

2. The current PTFE emulsion of PTFE copper clad laminate basically

no longer uses perfluorinated emulsifiers containing trace amounts, but all have switched to fluorine-free emulsifiers.

3. In the process of PTFE copper clad laminate, the water and emulsifier in the PTFE dispersion are completely evaporated, and the evaporated matter is treated by professional environmental protection equipment, which meets the relevant environmental regulations and emission standards.

4. PTFE copper clad laminate products do not contain PFAS restricted substances.

5. PTFE copper clad laminate has excellent electrical performance and reliability, and is an irreplaceable type of high-performance copper clad laminate in the global electronic circuit industry.

6. PTFE copper clad laminate will not cause harm to the environment and human body from the purchase and use of its raw materials, production process, and downstream application, and should be exempted.

Therefore, we sincerely hope that the "Proposal on Adding PFAS to the REACH Restriction Chapter" will be fully and widely consulted. We expect necessary and rational adjustments will be made to reduce the unreasonable impact on the global electronic circuit industry value

chain.

We thank you for your understanding and support.