Comment on a proposed restriction on the manufacture, placing on the market and use of per- and polyfluoroalkyl substances (PFAS)

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Japan Electronics Packaging and Circuits Association

Summary

Printed circuit boards (PCBs) which contain fluoropolymers even partly in its constituent, are widely used for antennas and amplifier substrates in high-frequency communications due to their high functionality. If this regulation is implemented, it is clear that the infrastructure that fundamentally supports the safety and convenience of social life will cease to function. Therefore, we request a 12-year derogation after the EiF (Entry into Force) for printed circuit boards using fluoropolymers for such applications. This document has been edited and combined into a single document in consideration of readability, although it is structured in accordance with the consultation form to be submitted on the ECHA website.

General Comment

JPCA is an organization whose members include manufacturers in Japan of printed wiring boards (PWBs), which are always built into electronic devices, as well as related equipment and materials' manufacturers and other related manufacturers who contribute to the midstream supply chain. First of all, the ECHA's proposal is highly appreciated as the one that will have a great impact in ensuring the health and safety of the human race and the continuation of stable daily life.

In this context, we are very concerned that the proposal includes elements that could seriously undermine the progress of information network technologies supported by wireless communications and the Internet, which contribute dramatically to the livelihood and security of not only people living in the EU region, but also humanity in general, and of regions and nations in particular. JPCA is also very concerned about this issue. A typical example is printed circuit boards using fluoropolymers, which are widely used in aerospace, military, and

in-vehicle applications, such as antennas for 5G communication devices, and are widely applied as materials that support the required characteristics of maximum gain and minimum return loss. In this application, the various unique properties of fluoropolymers are fully integrated and demonstrated at the same time.

In addition to antenna applications, it is also widely used in signal amplifiers and couplers in personal devices and in high-speed signal processing applications in data centers that handle big data. There is no other material that offers this level of performance for these applications at the same time, and the possibility of finding an alternative material remains unknown in future research and development. The same appeal is also made in the comments from related organizations of companies in the market for printed circuit boards using this fluoropolymer, so it is highly recommended that the reviewers refer to these comments.

JEITA：comment No.4543, JAPIA：comment No.4413

In addition, the fluoropolymer-based PFASs covered by this comment have not been proven to be hazardous, and we are skeptical of the need to regulate PFASs up to and including fluoropolymers (see also the comments of FCJ and JFIA).

FCJ：comment No.4168, JFIA：comment No.4521

IPC in the U.S. also shares the same viewpoint, and although their comments cover an even wider range of areas, including all electronics, they are basically appealing from the same perspective. Please refer to their comment also.

We apologize that we are not in a position to provide exact information on the use and management of PFAS in RO1 and RO2 (RO：Restriction Options) related applications, as we focus on the evidence that there are no substitutes for fluoropolymer-based PWBs in the application market and on the socioeconomic impact of regulation.

Sectors and (sub-)uses for the derogation period and requested derogation

(Related to Section III-R1 on ECHA's website for submitting comments)

Target sectors and requested derogations are:

- 12-year derogation after the EiF (Entry into Force) for copper clad laminates, prepregs and film materials containing fluoropolymers as components, and printed circuit boards composed of these materials, used for antenna applications of automotive millimeter wave radar in the field of transport in Annex E.2.10 of the Dossier Document.
- 12-year derogation after the EiF for copper clad laminates, prepregs and film materials containing fluoropolymers as components, and printed circuit boards composed of these materials, used in wireless communication equipment and in computers in high-speed wired networks in the field of electronics and semiconductors in Annex E.2.11 of the Dossier Document.

Analysis of alternatives and socio-economic analysis for the specific market of printed circuit board with fluoropolymer.

As for the derogation requirements as stated above, the following information is related to items of Section III-R6,R7,R8. These are based on the assumption that the individual questions a, b, c, d, e, f, and g in Section III are to be answered in R8, "Other identified uses".

○The annual tonnage and emissions (at sub-sector level) and type of PFAS associated with the relevant use) for question a. :

We are aware that the fluoropolymers mainly used in such applications are PTFE, PFA, and FEP, but there are also cases of inclusion of other fluoropolymers with PFAS structures. According to the information from related manufacturers, the annual use of fluoropolymers in the EU is estimated at approximately 350 tons as a maximum. However, we do not have enough information on the disposal and emissions of fluoropolymers in the manufacturing process of PCBs in the EU.

○Major performance fluoropolymers in the application concerned and its alternative information) for questions b, d, e, and f. :

The following is a breakdown of the key performance and alternative

information provided by fluoropolymer-based PWBs, categorized by major application.

For antenna applications in aircraft, base stations, radar equipment for transportation equipment, etc., the required characteristics include optimizing the gain and directivity of the electromagnetic waves received and transmitted, excellent dielectric properties to minimize signal loss, and heat, weather, and moisture resistance in accordance with the environment to which they are exposed. Alternatives include PPE and modified polyimide materials for low GHz frequency applications, or LCP for applications that require flexibility, especially in printed circuit boards (*1), but the only material that offers a total balance in terms of performance is a material that contains fluoropolymers as a component. As the target frequency increases, alternative materials that do not contain fluoropolymers will no longer be applicable from the viewpoint of transmission characteristic loss suppression *2)*3). There are currently no commercially available alternative materials that exhibit equivalent electrical and mechanical behavior, and it will take at least five years to invent a replacement, if at all, and another 5-10 years to demonstrate reliability at the commercial level.

*1)
Satoshi Okude, Wiring Board Material Technology for Millimeter Wave Application, *Fujikura Technical Review, 2022*
https://www.fujikura.co.jp/eng/rd/gihou/backnumber/pages/__icsFiles/afieldfile/2022/03/02/51e_02.pdf
*2)
Lingling Wang, Chenchen Liu, Shizhao Shen, Mingzhen Xu, Xiaobo Liu, Low dielectric constant polymers for high speed communication network, *Advanced Industrial and Engineering Polymer Research Volume 3, Issue 4, October 2020, Pages 138-148*
https://www.sciencedirect.com/science/article/pii/S2542504820300403
*3)
Tomoya Hosoda, Developments in fluorinated materials for high-frequency, high-speed, printed circuit boards, *AGC Research Report 70 (2020)*
https://www.agc.com/innovation/library/detailhtml/1201559_4283.html

Fluoropolymer-based PCBs are also suitable for applications in power amplifiers and couplers built into personal devices, such as smartphones and PCs. PPE, modified polyimide materials, and LCP materials all lack in terms of balance when considering characteristics such as the need for a low dissipation factor ("Df") to minimize loss of amplified signals due to inherent heating, and thermal stability to avoid material breakdown and prevent arcing during high-voltage operation.

Fluoropolymer-based PCBs are also incorporated into the PWBs built into servers and routers in data centers that are constructed using wired Ethernet. In the past, materials with a certain degree of dielectric constant and dissipation factor, such as PPE-based materials, could be used in place of fluoropolymer-based PCBs, but as 800G and 1.6Tbps signal processing becomes mainstream in the future, there will be increasing demand for alternatives for high-speed signal processing and for minimizing transmission loss, which is essential for thermal management.

In general, there are various options for the form of fluoropolymer-based printed circuit board materials, such as the presence or absence of the reinforcement to control mechanical strength or the introduction of inorganic fillers into the composition to control thermal expansion, depending on the purpose of the material. However, all of these options can be utilized by taking advantage of the composition of fluoropolymers.
*4) See also the public comment of Rogers No:6006.
*5) https://resources.altium.com/p/types-ptfe-materials-rf-pcb-design

○Socio-economic impact in case of non-substitutability for the use in question)
for question g. :
As mentioned above, the market for fluoropolymer-based PCBs is infrastructure, devices, transportation/mobility, etc. related to digital network technologies that support not only the comfortable/secured lives of citizens but also national security at large. The loss of their use would mean a return to the pre-2010s era, when smartphones first appeared on the scene, at the very least. This would mean the collapse of the current social infrastructure in all its related aspects for consumers, the state, and businesses.

○Regarding the production output of fluoropolymer-based PWBs) for questions g, and a. :

According to the information available from at JPCA, the global production of fluoropolymer PCBs are estimated to be about 2 billion EUR per year. Assuming that the total amount of fluoropolymer PCBs produced in the EU region, either the fluoropolymer PCBs themselves or devices with built-in fluoropolymer PWBs that are put on the market in the form of imports, is equivalent to 30% of the global PWB production, the total annual value is estimated as 600million EUR. However, it is easy to analogize that this amount would increase hundreds or even thousands of times if converted into the value of final products such as telecommunication equipment that incorporate these fluoropolymer PCBs.

○Other information on the number of companies involved in the manufacture or use of other fluoropolymer-based printed circuit board products) for question c. :

We regret that we do not have any exact information for this.