Industrieverband
Halbzeuge und Konsumprodukte
aus Kunststoff e.V.

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Open letter in response to Chemsec article dated February 10, 2022
The Teflon chemical PTFE is often touted as a safe cousin of toxic PFAS. But is it really? – ChemSec

pro-K's response to the article:
Per- and polyfluoroalkyl substances (PFAS) are a large family of substances with widely diverse properties. The term "PFAS" is a broad, general, non-specific term, which does not inform whether a compound is harmful or not, but only communicates that the compounds under this term share the same structural trait of having a fully fluorinated methyl or methylene carbon moiety. The substances defined as PFAS are distinct substances with very different properties: polymers and non-polymers; solids, liquids and gases; persistent and non-persistent substances; highly reactive and inert substances; mobile and insoluble (immobile) substances; and (eco) toxic and non-toxic chemicals.
The Chemsec article on PTFE cites factually and scientifically incorrect statements which we would like to highlight as below:

1. **PTFE used in *'plethora of consumer products'***

The article mentions few PTFE applications of consumer use such as *'non-stick cookware, ski wax, car interiors and dental floss'*. It is pertinent to note that PTFE is primarily used in industrial applications such as aerospace, automotive, production of chemicals, power, renewable energy, electronics and semiconductors, medical devices, pharmaceuticals, mobile phones, tablets and PCs, technical fabrics, building and construction.
PTFE is used in a wide variety of applications due to its unique combination of functionalities such as durability, mechanical strength, dielectric strength, chemical inertness, bio-compatibility, non-wetting, non-stick, weatherability, high resistance to temperature and fire. PTFE is a critical material for innovation and deemed necessary to achieve the goals that the EU defined such as decarbonization, renewable energies or competitiveness in the digital transition. It is used in numerous technologies, industrial processes and everyday products that are critical for human health, safety, societal needs, the environment and sustainable industry. There are no known alternatives that can replace the high performance stemming from a combination of properties provided by fluoropolymers in "virtually every critical application in which they are used". Therefore, PTFE is an indispensable enabler of the European Green Deal, UN Sustainability Development Goals and fulfils societal needs.

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The article deliberately chose to mention consumer use applications particularly of low importance while avoiding mention of critical and widely used applications for human health, safety, societal needs and the environment.
By presenting partial information, the article incorrectly portrays PTFE as a substance used in subcritical applications.

2. Lack of evidence on safe use of PTFE

The article incorrectly points to insufficiency of data related to safe use of PTFE by stating, '*the notion of PTFE as safe to use has persisted among its proponents, even though there is not much evidence for anything, really'.*
Henry et al 2018[1] paper on four fluoropolymers including PTFE satisfying Polymers of Low Concern (PLC) criteria states that PTFE have thermal, chemical, photochemical, hydrolytic, and biological stability. PTFE has been extensively tested to comply with US and EU food contact and global medical device regulations (e.g., USFDA, CFDA, Korea MFDS, Japan PMDA), including ISO 10993 biocompatibility testing and preclinical animal testing. Toxicology studies on PTFE demonstrate the absence of acute or sub-chronic systemic toxicity, irritation, sensitization, local toxicity on implantation, in vitro and in vivo genotoxicity, hemolysis, complement activation, or thrombogenicity.

3. Lack of information of PTFE production

The article incorrectly states that, *'Little is known about where PTFE and other fluorinated polymers are produced in the world as there are no regulations in place that require chemical producers to disclose this'.*

This statement is incorrect. There are only a handful of PTFE manufacturers globally and the information is easily accessible online through their websites and also through trade associations like Fluoropolymer Product Group (FPG), a sector group under PlasticsEurope. Information on PTFE manufacturers and their production volumes can also be easily accessed through market study reports such as Chemical Economics Handbook (CEH), IHS Markit.

4. Use of fluorinated polymerization aids for the manufacture of all fluoropolymers

The statement *'in order to produce PTFE you need to use PFAS, which is obviously a huge problem'* is not entirely acceptable or accurate.

PFAS used in the manufacture of PTFE are intermediate products and their emissions to the environment can be largely controlled.

PTFE is produced by suspension and emulsion polymerization technologies in almost equal ratios. Suspension polymerization does not require the use of polymerization aids (surfactants), while the emulsion polymerization process requires the use of such polymerization aids.

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This means: About 50% of all fluoropolymers are already now produced without the use of any PFAS!

Industry is working on reducing PFAS emissions related to fluoropolymers by implementing the following emission control technologies:

- Maximising recovery and recycling of fluorinated polymerization aids to reduce the overall requirement and the environmental footprint of PFAS
- Waste water treatment achieving over 99% removal of fluorinated polymerization aids prior to discharge
- Gaseous emissions of PFAS from the manufacturing processes are fully captured and routed to a thermal oxidizer where they meet up to 99.99% destruction and removal efficiency
- Parallel to this, individual companies are developing manufacturing processes of emulsions that do not require a PFAS in order to produce their entire PTFE portfolio

According to the RMOA study commissioned by an independent consulting firm Chemservice, the following list provides details on the Best Available Technologies (BAT) implemented for emissions control at fluoropolymer manufacturing sites:

• Water and wastewater emissions:
  Physical separation
  Chemical precipitation
  Stripping
  Filtration
  Ion exchange (IE)
  Granular activated carbon (GAC)
• Air emissions:
  Caustic scrubber
  GAC
  Regenerative thermal oxidation (RTO)
• VOC emissions:
  Filtration
  Caustic scrubber
  GAC
  RTO
• Dust (solid particles) emissions:
  Filtration
• PFAS polymerization aids emissions (additional to the BAT listed above):
  Specific recovery/recycling techniques (rates over 98%)
  Incineration

Furthermore, as a part of RMOA study, the Fluoropolymer Products Group (FPG) member companies voluntarily committed to the following responsible manufacturing principles:

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1. To maintain, continuously improve and/or develop best available techniques in the manufacturing processes and management of environmental emissions related to fluoropolymers.

2. To maintain and continuously improve and develop containment, capture, and recycle technologies to minimize emissions into the environment from PFAS substances intentionally and non-intentionally present in fluoropolymers including fluorinated raw materials, polymerization aids, monomers, intermediates, and process chemicals as well as by-products.

3. To continue investigating and developing R&D programs for the advancement of technologies allowing for the replacement of PFAS-based polymerization aids during fluoropolymer production. Where proven technically feasible, environmentally sound, and viable at an industrial and commercial scale, to replace the use of PFAS as polymerization aids.

4. To continue to pro-actively work with its downstream users to increase recyclability and reuse of its products and develop R&D programs in line with the objectives of a circular economy.

5. To continue to minimize the exposure levels for workers to chemicals used in the fluoropolymers manufacturing process.

6. To introduce new or expand existing third-party assessment programs to help verify progress towards our members' commitments.

7. To commit to an open dialogue with policymakers, employees, and other key stakeholders.

5. Cookware applications

There is a concern that PTFE may release dispersive low carbon chain PFAS substances during elevated temperatures of cooking. PTFE starts to disintegrate slowly at temperatures above 350ºC and cooking of food is done at temperatures much lower than 350ºC. At such high temperatures, all food items will be destroyed. Most cooking oils and butters start to burn between 170ºC and 230ºC and a pan coated with PTFE, when used for which it is intended, will never reach 350ºC.

Therefore, the article contains a scientifically incorrect statement, ***'And when does PTFE get really hot? When you fry something in your frying pan'*.** It is incorrect to assume that during cooking of food, PTFE may degrade and release any harmful PFAS [3].

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6. Incineration of PTFE

The RIVM report [4] on PFAS in waste incinerator flue gases published 2021, affirmed that PTFE, the most stable fluorine-containing polymer, achieves complete thermal decomposition at a temperature of about 800°C. It can therefore be assumed that other fluorine-containing polymers also thermally decompose completely at a temperature of 850°C [5]. Temperatures at the pyrolysis front and the combustion front in the waste-burning bed range from 900 to 1100°C (Ménard et al., 2006; Asthana et al., 2006), which is well above the temperature of 800°C at which the complete thermal decomposition of PTFE is achieved.
The report also states that, “based on a literature review, RIVM expects that most of the PFASs will largely degrade during the incineration process and then be removed when the flue gases are cleaned. The remaining PFASs are expected to be removed during the recovery of the carbon dioxide” [4].
Therefore, there is sufficient evidence to demonstrate that the statement, ***‘Burning of PTFE creates PFAS’*** is not true. The article does not entirely tell the fact that during normal incineration conditions at temperatures of 800°C and above, PTFE is completely decomposed.

7. Irreplaceability of PTFE

The statement in the article, ***‘Several alternatives that perform equally well’*** is not factually correct.

The unparalleled properties of PTFE make them critical material for a broad range of applications and industrial sectors. With a unique combination of functionalities, PTFE is irreplaceable across many key sectors/applications. Alternatives to PTFE, if exist, escalate safety risks, carbon footprint, technology regression, and do not match the advanced performance of fluoropolymers.
As an example, 5G data transmission is impossible without the use of perfluorinated fluoropolymers such as PTFE or FEP.

In some applications where PTFE is used today, the industry could use an alternative but in all cases though there is a trade-off to be made in terms of performance and/or safety and innovation where EU industry might lose its technological superiority over other economies and could put Europe’s climate and energy goals at risk.

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3. FEC Position paper related to the consultation on PFAS dated 5th August 2020
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5. Aleksandrov, Krasimir, et al. "Waste incineration of Polytetrafluoroethylene (PTFE) to evaluate potential formation of per-and Poly-Fluorinated Alkyl Substances (PFAS) in flue gas." Chemosphere 226 (2019): 898-906.

With kind regards

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