

PFAS in the semiconductor industry

Meeting with [REDACTED] REACH





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TEXAS INSTRUMENTS

xfab

ZVEI:
Die Elektroindustrie



The voice of the semiconductor industry in Europe

Represent the interests of the European-based semiconductor industry and advocate for its international competitiveness.

- most R&D-intensive sector
- highly-developed global supply chain
- fierce competition & price fluctuation
- short innovation cycles
- multiplier for growth, electronics boost innovation
- global market estimated at \$ 556 billion in 2021 (+26.2% yoy)
- Europe strongest market for automotive (29%)

EU

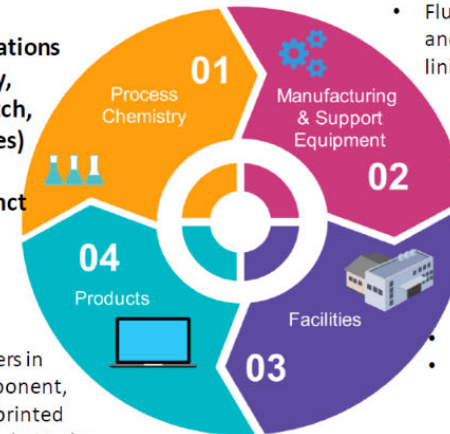
- ca. 10% of global market
- direct employment 200.000
- indirect up to 1.000.000
- ESIA is member of the World Semiconductor Council (WSC)



PFAS in the SC industry

- PFAS are used in low concentrations in specialty formulations in different SC manufacturing processes, such as photolithography due to their high technical functionality
- PFCs are used for etching
- Photolithography and etching are the fundamental basis of SC manufacturing, making PFAS/PFCs critical for continued SC manufacturing and innovation in Europe
- The SC industry will need to obtain appropriate derogations for PFAS

- Constituent of specialty process chemistry formulations (photolithography, chamber clean/etch, and other mixtures)
- Direct criticality
- >13 types of distinct uses / material functionalities

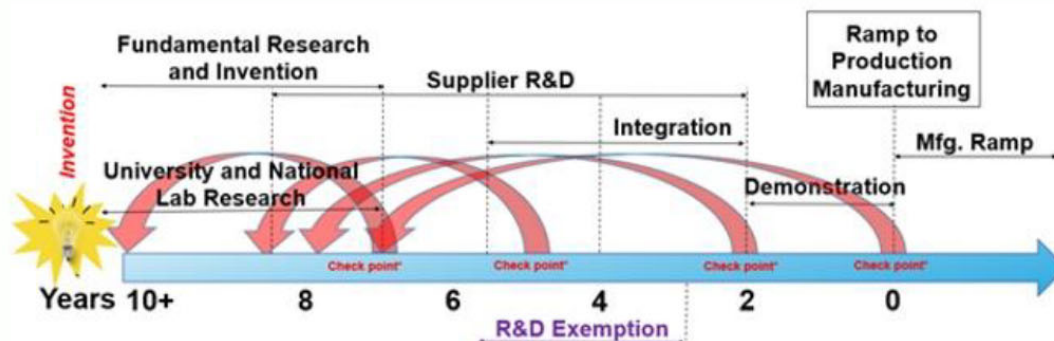


- Fluoropolymers in articles (component, wire, cables, printed circuit boards, batteries, insulators, capacitors,...)

- Semiconductor manufacturing equipment (HTFs)
- Fluoropolymer articles in manufacturing equipment and chemical distribution systems (filters, tubing, linings, o-rings, etc.)
- Factory infrastructure 'Fabs'
- Fluoropolymer articles in water purification, chemical delivery and waste management systems (tank and duct linings, pipes, etc.)

PFAS in the SC industry

- No feasible alternatives have been invented
 - Technical feasibility to support critical performance are key attributes of any feasible alternative
- It is envisaged that it will take 10+ years to qualify and implement in practice non-PFAS alternatives with the same technical properties, after such an alternative has been invented.
- For some applications, an alternative might never be invented





Risk Management in the SC Industry

- Stringent risk management measures and safety practices to prevent release of chemicals during all stages of manufacturing
- No release to the workplace environment during normal production
- Closed system manufacturing equipment installed in a clean room
- Automated chemical delivery systems create barrier between highly skilled workers and manufacturing process, protecting against chemical and physical hazards



PFAS Consortium

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- The industry and its key suppliers have formed a Semiconductor PFAS Consortium to collect the technical data needed to better understand PFAS use in our industry and inform policy development, including:
 - Developing concepts by applying the pollution prevention hierarchy, where possible:
 - to reduce consumption or eliminate use of PFAS containing specialty materials,
 - to identify alternatives for PFAS containing specialty materials, and
 - to minimize and control emissions of PFAS
 - Identification of research needs, and
 - Development of socioeconomic impact assessments
 - The consortium membership includes semiconductor manufacturers and members of the supply chain including chemical, material and equipment suppliers



The way forward

- Projects that are already in the public domain
 - Horizon Europe membrane distillation application (more information available [here](#))
 - Semiconductor Research Corporation
 - US-based, includes ESIA member companies
 - Collaboration between SC industry and academia
 - More information available [here](#)
- SC industry is prepared to invest more into R&D on PFAS
 - SC manufacturing: PFAS as a process chemical
 - Emissions: Minimize PFAS release



PFAS and the SC supply chain

- PFAS consortium has helped get the supply chain engaged in PFAS efforts
- SC supply chain is global and consequently vulnerable to disruptions
- Compared to SC industry in other regions where PFAS is not regulated, the European SC industry would be placed at a competitive disadvantage

PFAS and the F-Gas Regulation

- The F-Gas Regulation has been the one-stop-shop for F-Gases and has been successful in reducing emissions
 - Taking certain F-Gases out of the scope of the F-Gas Regulation and including them in the REACH restriction will cause disruptions
- F-Gases for servicing and maintenance of refrigeration equipment
 - Now: Equipment with charge size of >40t CO₂(e) banned starting 2030
 - Proposal removes differentiation of equipment with <40t of CO₂(e) charge size
 - Renders semiconductor chiller fleet obsolete in 2030
 - Quantity in each chiller is low, number of chillers is high, overall amount of refrigerant is small and potential loss of refrigerant is low
 - Strict measures in place to minimize fugitive emissions
 - Potential environmental benefit is negligible compared to the resources required to qualify new gases

Questions to the Commission

- Extension of REACH Restriction Derogations
 - PFHxA REACH Restriction process is well underway
 - In the RAC and SEAC background documentation, it was noted that an extension to the 12-year derogation for the semiconductor industry is only justified when manufacturers provide more detailed information on substitution efforts and prepare detailed substitution plans
 - What would such a review process look like for an extension of the derogation?
- The legal aspect of the Essential Use Concept will not be part of the proposed REACH Restriction on PFAS
 - Nonetheless, essentiality will be used to some extent in the PFAS Restriction. How will that work?
- The final RAC and SEAC opinion on the restriction of PFHxA uses a definition of “Semiconductors and semiconductor related equipment”. Is it fair to assume that this also covers semiconductor manufacturing equipment?



Thank you for your attention!

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