

Chemical Watch Conference 'Essential Uses' of PFAS in the EU

**Case study: The manufacture of
semiconductors**

SEMI speeds the time-to-better business results for its members across the global electronics design and manufacturing supply chain.



CONNECT - COLLABORATE - INNOVATE - GROW - PROSPER



Presentation Outline

SEMI at a glance

Semiconductors as a key and an essential technology

PFAS in semiconductor manufacturing

Essential use concept

Concluding remarks

SEMI connects the global electronics supply chain.

SEMI is the industry association connecting more than 2,400 electronics design and manufacturing companies worldwide, including nearly 300 European headquartered businesses.

SEMI members are responsible for the innovations in materials, design, equipment, software, devices and services that enable smarter, faster, more powerful and more affordable electronic products.



Strategic importance of semiconductors for Europe's Digital Sovereignty

“We need to be clear: without an autonomous European capacity on microelectronics, there will be no European digital sovereignty.”

“...These components, commonly known as processors or microprocessors, chips or sensors, are at the start of most of the key and strategic value chains such as connected cars, phones, Internet of Things, high performance computers, edge computers, defence, Artificial Intelligence.”

**Thierry Breton, European Commissioner for Internal Market
Speech at Hannover Messe Digital Days, 15 July 2020**

Semiconductors enable everything digital and shape the modern society.

Screens & Monitors



Renewable Energy



Telecom & 5G



Remote working



Medical Science
COVID-19



Artificial Intelligence



Electronic components and systems enable around 50% of European GDP due to its involvement in many sectors*

Smartphones



EV Batteries



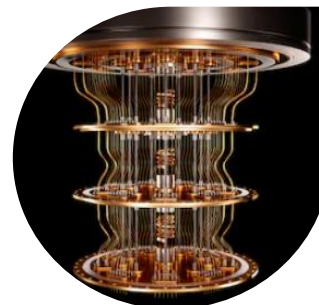
e-Learning



Connected & electric cars



Quantum Computing



Data Society



Complexity of semiconductor manufacturing technology



Capital-intensive

Manufacturing fab can cost up to **15+ billion EUR** to set up (DECISION, 2018)



High R&D intensity

Average **15-20%** of sales invested in R&D (SIA, 2019)



Complex process / global supply chain

One semiconductor manufacturer can have **16.000** suppliers globally (SIA & Nathan Associates, 2016)



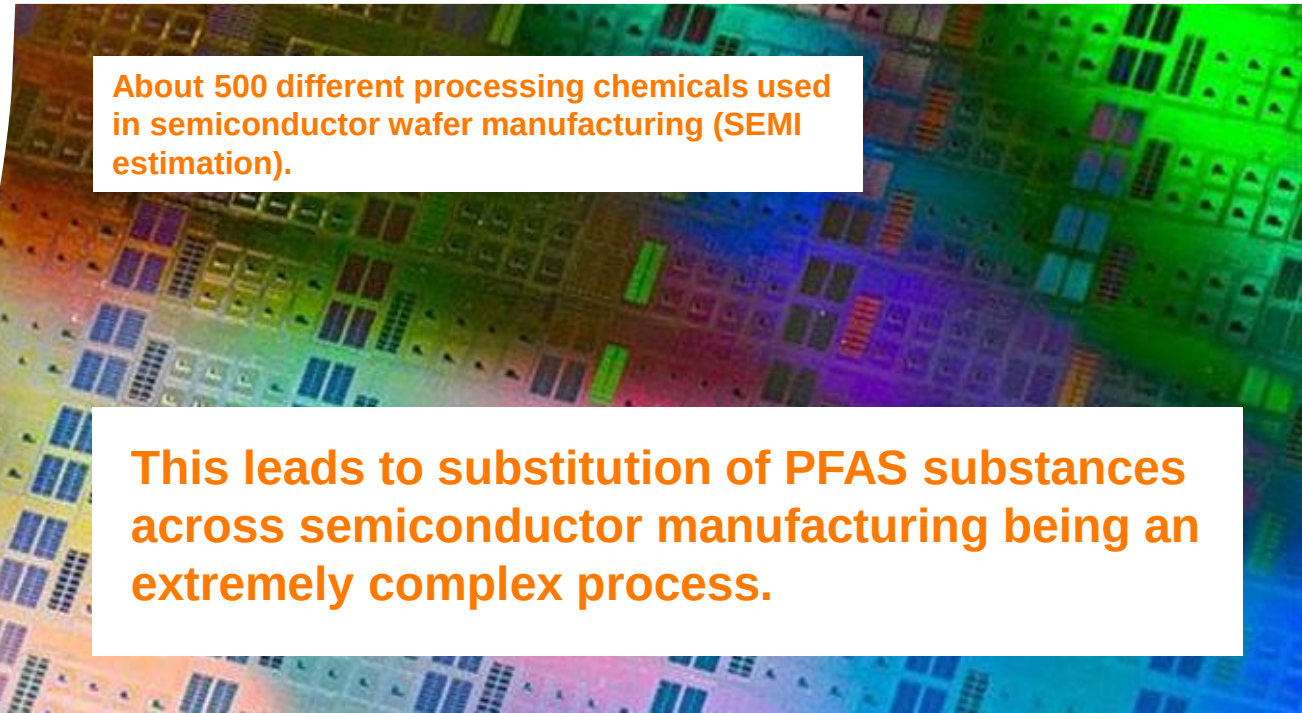
High-skilled employment

EU semiconductor ecosystem provides **250.000** direct jobs and **2.5M** jobs in the end-to-end electronics supply chain (Deloitte & VVA, 2020)



Semiconductor equipment are typically made of millions of articles.

ASML/Bart van Overbeeke



About 500 different processing chemicals used in semiconductor wafer manufacturing (SEMI estimation).

This leads to substitution of PFAS substances across semiconductor manufacturing being an extremely complex process.

PFAS in semiconductor manufacturing (non-exhaustive list)



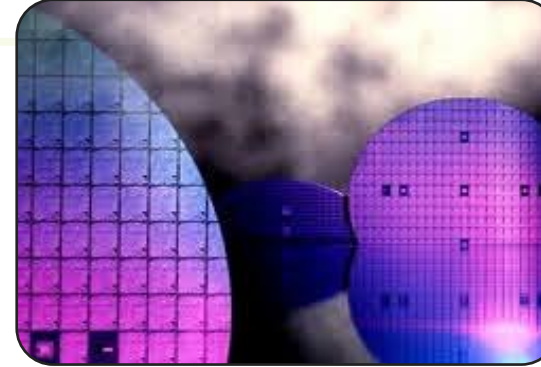
Semiconductor Factory Infrastructure

- Refrigerants
- Chemically resistant distribution piping and structural materials



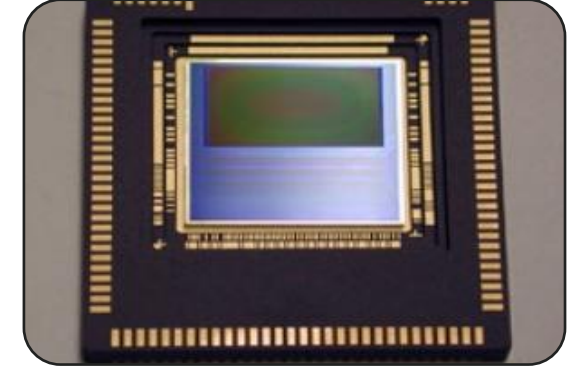
Semiconductor Equipment

- Chemical containers, tubing, valves, filters, gaskets, air filtration systems, heat transfer fluids, lubricants...
- Many electronic components contain PFAS polymers



Semiconductor Chemicals

- Specialty formulations in photolithography (photoresists and antireflective coatings)
- Etching processes
- Barrier layers



Imaging Semiconductors

- Specific color filter materials (e.g. used in medical endoscopic cameras, displays and automotive applications)



PFAS is essential for semiconductor manufacturing

UNIQUE PROPERTIES

Key to the semiconductor industry to ensure **performance** and **durability**:

- low surface tension
- high heat & chemical resistance
- high thermal stability & dielectric properties
- radiation stability
- compatibility with other chemicals

NO SUITABLE ALTERNATIVES

- No PFAS-free alternatives are currently available that provide adequate **functional properties** and **performance**.
- Requalification is an **extremely complex** process differing across technologies. Implies **disproportionate costs and long development timeframe (approx. 15+ years)**.
- **Risk** of inability to produce and supply the EU with semiconductor technology.



Essential use of PFAS in semiconductor manufacturing enables our modern society.

The Essential Use Concept



The essential uses definition should take into consideration the following along the entire supply chain:

**“Essential Use”
should enable
and not hinder
technological
innovation**

**“Essential Use”
should apply
across the whole
supply chain**

**“Essential Use”
should enable
EU’s Critical
Infrastructures**

**“Essential Use”
should support
EU’s Strategic
Objectives**

Concluding Remarks



Semiconductors are **the backbone of all key value chains in Europe** (digital infrastructure, high-performance computing, connected cars, artificial intelligence...).



Unique PFAS properties are essential to semiconductor manufacturing.

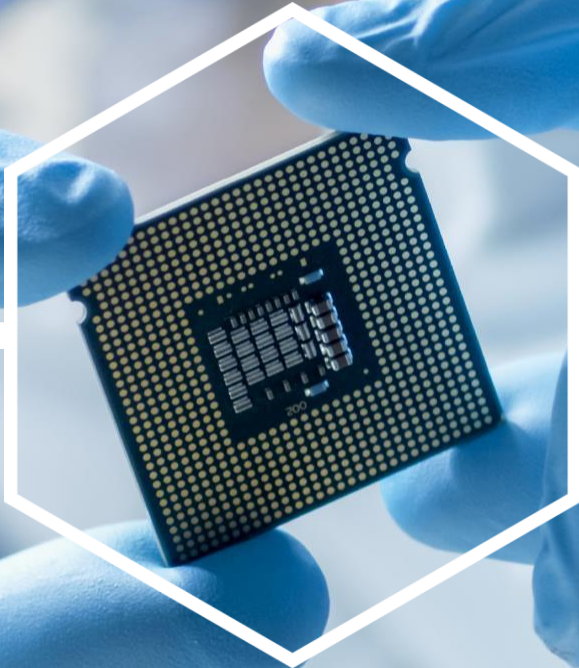


Without PFAS, **no EU autonomous digital capacity.**



The essential use concept should enable **continuing use of PFAS** for semiconductor manufacturing.

Without this...



...none of these.