TRILO SCHEIBE -

your Locked-In Washer

SCHNEIDER
PRÄZISIONSTECHNIK

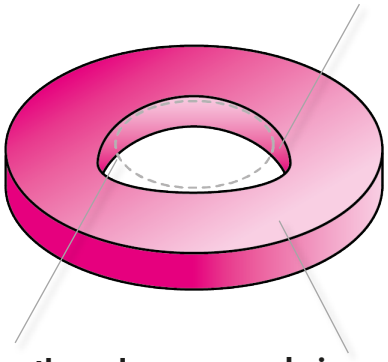
What is the Triloscheibe?

A new spin on a Classic Washer

That's what the *Triloscheibe* stands for

With its name deriving from trilobular, a shape that is generally triangular but with rounded corners, the *Triloscheibe* is in first principle a **non-losable sealing disk**. It has a high degree of flexibility in material selection, which greatly expands the number of potential use cases.

Tribular inner portion
The pressing shapes the distinctive trilobular interior, ensuring a precise and airtight seal.



Screw thread
The washer is pressed onto the screw thread without damaging it, preserving full functionality and ensuring a secure, tight solution

round circumference
After pressing, the originally trilobular screw seamlessly aligns with the socket for a secure fit.

Strengths:
- Reusable
- Water/Gastight
- Screw geometry and washer material are versitile

Weaknesses:
- strong competitive market
- High Torque
- Material Fatigue

Opportunities:
- Fasteners can be reused
- Modification options for niche applications
- Better performing alloys

Threats:
- Competitive technologies
- Innovation decline

DIBOND® COMPOSITES
VULCANIZED METALL
STAINLESS STEEL
ALUMINIUM
COPPER
BROZE
BRASS
STEEL
ZINC
...

Just steel?

Triloscheibe - available in various metals

Due to flexibility regarding material selection, the ability of these disks for surface modification and the inherent advantages of cold-forming, there is a great number of potential use-cases. This flexibility also allows the use of the even in challenging environments, including but not limited to electro-chemically active, acidic/alkaline environments. Another aspect which allows for some unique use case, might be a potential bio-compatibility (depending on the material) which could allow the Triloscheibe to be used in implants. Based on this unique environment, special materials such as titanium and certifications are necessary.

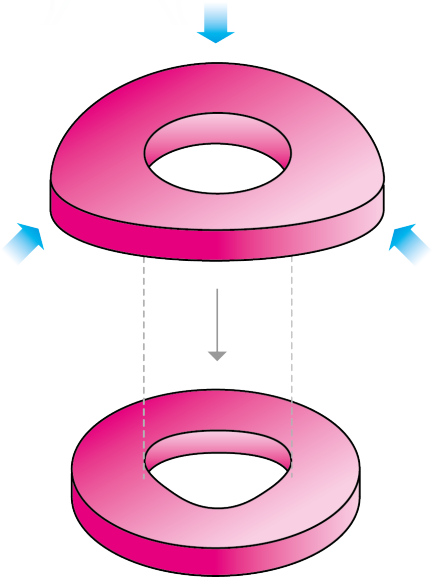
The Manufacturing

From trilobular to the Ideal washer

The cold-forming process in combination with the prior machining of the *Triloscheibe* inherently holds several advantages. These include primarily the design and material flexibility along with the high precision and accuracy required for the sealing capability. Furthermore, this manufacturing process allows for quick and cost-effective adjustments of the design and/or material, which allows for smaller charges still being profitable. The short-comings of this manufacturing process mainly arise from the machining aspect: waste production, wear of the required machining tools and a production time which rises linear with the number of parts within a charge

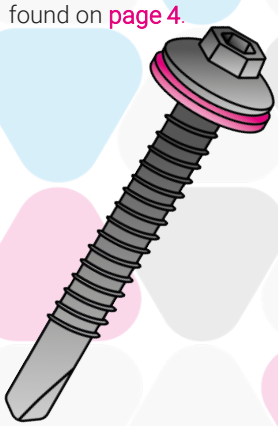
01.
Machining
(patented)

02.
Forming
(patented)



Aerospace

Additional information regarding the use of the Triloscheibe in aerospace applications can be found on page 4.

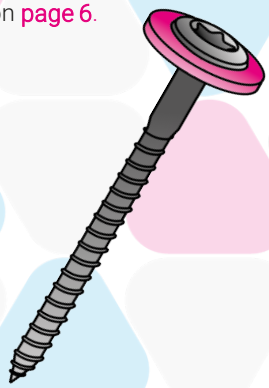


Semiconductors

While not directly useful in the context of fastening chips or other components, the Triloscheibe holds potential in the machine which produce semiconductors. More can be found on page 5.

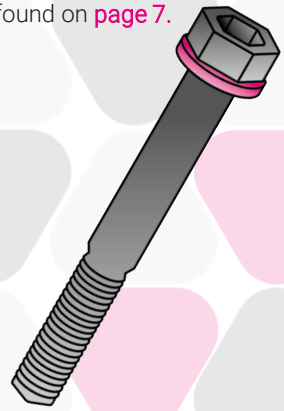
Home appliances

In the context of reusable sealing methods and in combination with new legal developments, the Triloscheibe has several use-cases in home-appliances. More on that on page 6.



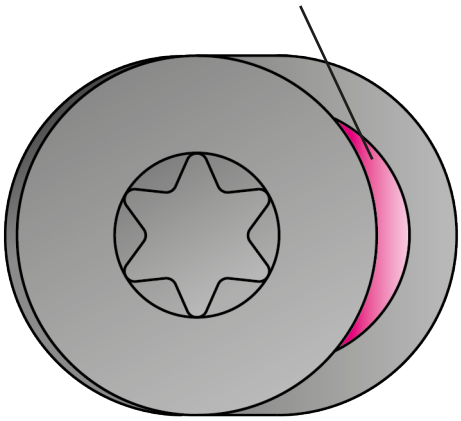
Chemical industry

By its very nature, the chemistry has a great need for sealing methods. An application that can be covered by the Triloscheibe. Further information can be found on page 7.



Leakage point

Attempting to press a regular washer into a captive design results in misalignment, creating points where the washer is imprecisely positioned, leading to potential leakage



Water & Gastight

Always on spot

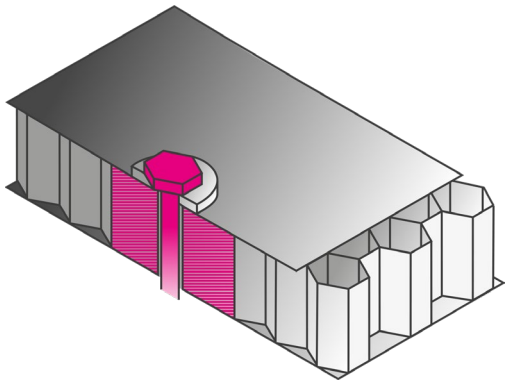
Pressing a regular washer on two sides around the screw often creates a significant gap, rendering it unsuitable for sealing applications. In contrast, with the trilobular sealing disk pre-attached to the screw, the assembler handles fewer components and no longer needs to be concerned with the precise positioning of the washer. Additionally, the assembly process is more efficient, as it has been streamlined into a single step. Additionally, there are some downstream cost savings including reduced labor costs and improved inventory management. The product can be made more ecologically friendly, since there is no separate packaging required for the disks and screws.

AEROSPACE

['ɛə.roʊ.speɪs] – ***noun***

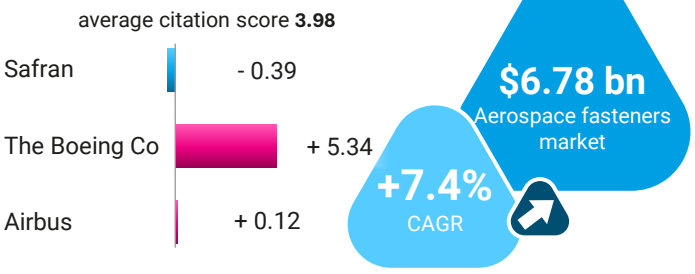
Aerospace refers to the branch of technology and industry involved in the design, development, production, and maintenance of aircraft, spacecraft, and related systems and equipment. It encompasses both aeronautics (atmospheric flight) and astronautics (space flight).

Related: Aviation, Aeronautics, Astronautics, Avionics, Propulsion, Spacecraft, Satellite



MARKT
INVESTMENTS AND ACTIVITY
What are the applicants doing?

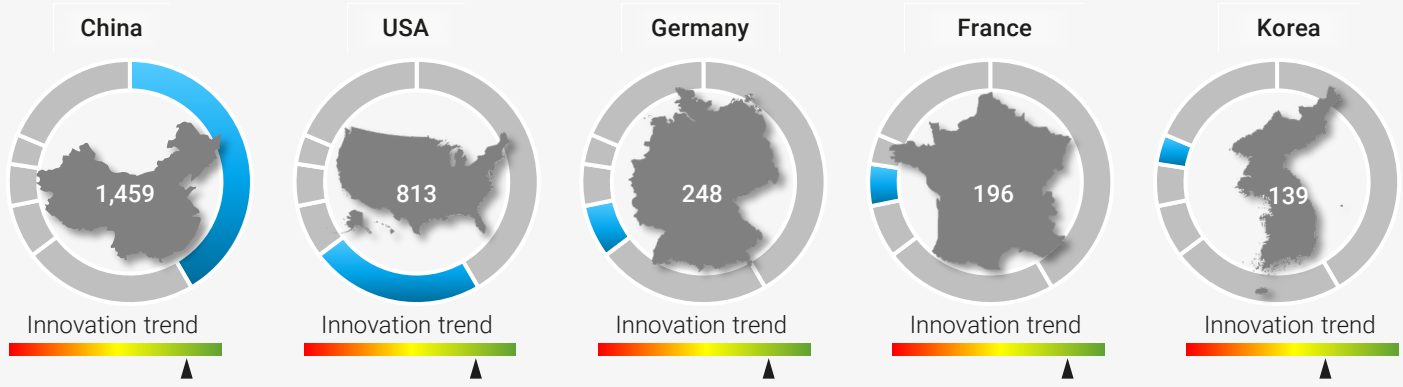
Out of the main applicants in aerospace fasteners, BOEING's innovation is the most impactful, compared to the average citation score in the aerospace market.



Ready for take-off
Mature technology in a growing market

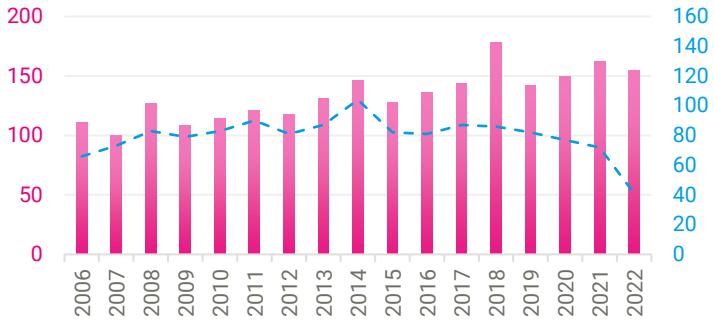
The divergence between CAGR and PAGR scores by a factor of 2, shows that the mechanical fastener technology has already reached a mature state within the market. Nonetheless the general market trajectory is upward, with the aerospace market outperforming average industry growth rates by a factor of 2.

PATENT APPLICATIONS FOR FASTENERS (BY COUNTRY OF ORIGIN)



INNOVATION
TREND DEVELOPMENT

Aerospace mechanical fastening innovation is growing slightly year over year and will continue to innovate



AIRBUS TAKES OFF
TOP 5 KEY PLAYERS

AIRBUS #1 61 patents
BOEING #2 59 patents
SAFRAN #3 31 patents
EUROCOPTER #4 18 patents
HOWMET #5 15 patents

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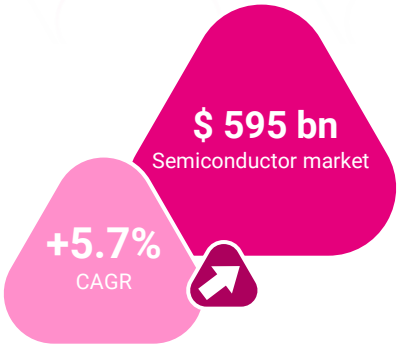
SEMICONDUCTORS

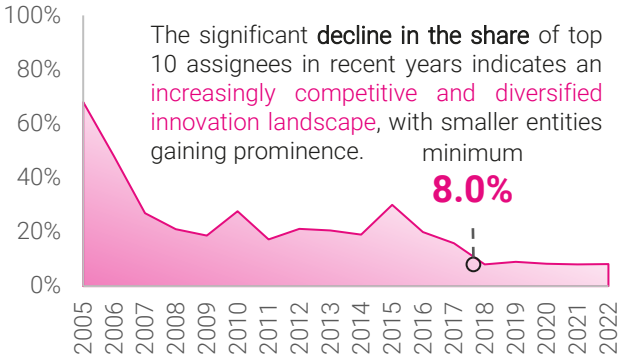
[sɛm.i.kən'dʌk.tər] – ***noun***

Semiconductors are materials, such as silicon, used in manufacturing electronic devices like integrated circuits. In semiconductor manufacturing, airtight washers and fasteners ensure secure assembly of sensitive components, maintaining stability and protection against contamination during the precise production process.

Related: Cleanroom, Die attach, Lithography, Micro-electronics, Packaging, Precision

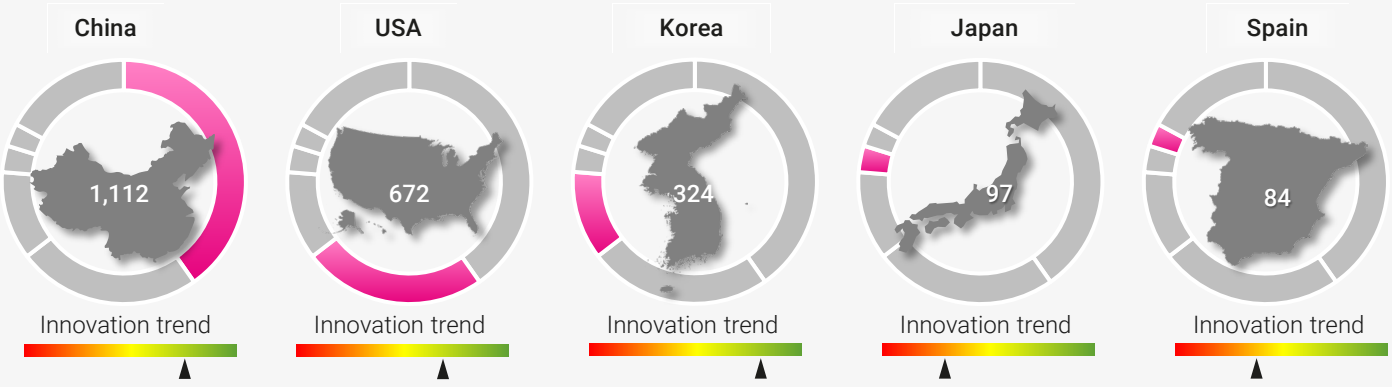


INNOVATION LANDSCAPE
APPLICATION SHARE OF TOP 10 ASSIGNEES

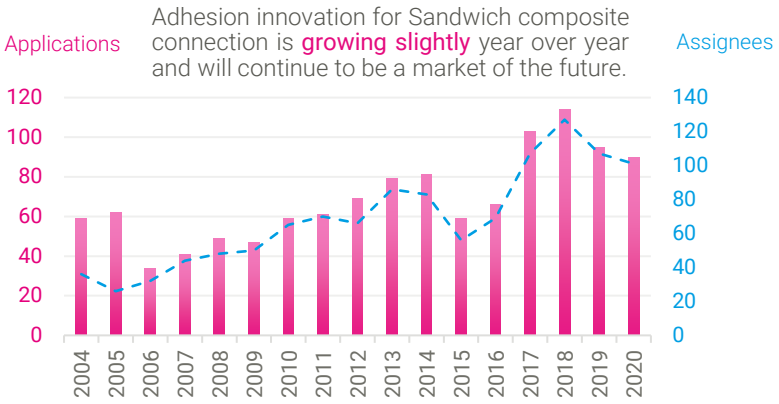


CARS, SMARTWATCHES AND AI
SEMICONDUCTOR MANUFACTURING IS ESSENTIAL FOR THE FUTURE

With the final product being a main component in many modern consumer product, the general market development has experienced a dramatic upward surge, which results in a higher demand in upstream infrastructure, i.e. semiconductor manufacturing capabilities. According to a recent report by Bain & Company, the adoption of AI could trigger a 30% jump in demand for key chip components by 2026, primarily driven by the growing need for GPUs in data centers and personal devices.



INNOVATION
TREND DEVELOPMENT



SAMSUNG FAR IN THE LEAD
TOP 5 KEY PLAYERS

SAMSUNG #1 118 patents
DONGBU #2 11 patents
ENTEGRIS #3 9 patents
IRONRIDGE #4 9 patents
FUJIKIN #5 9 patents

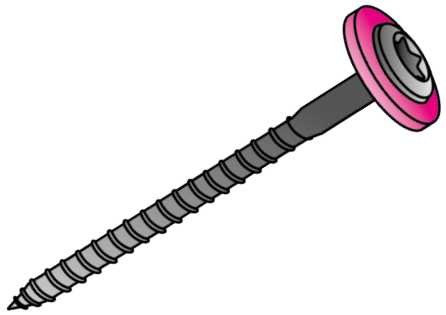
white ip group

HOUSEHOLD APPLIANCES

[ˈhaʊs.həʊld əˈplaɪ.ənsɪz] – ***noun***

In manufacturing, household appliances refer to large domestic devices like fridges, ovens, and freezers. Fasteners and washers play a crucial role in ensuring secure assembly, preventing air leakage, and enhancing durability in sealed compartments and mechanical parts.

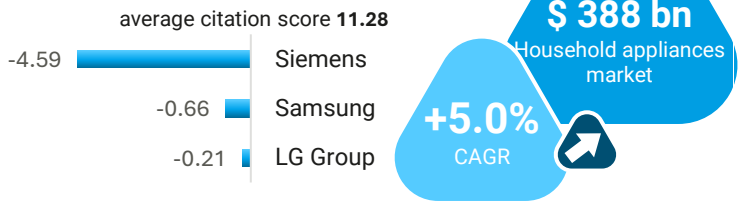
Related: Air sealing, Assembly line, Durability, Fastening solutions, Leak prevention, Manufacturing efficiency, Sealed components

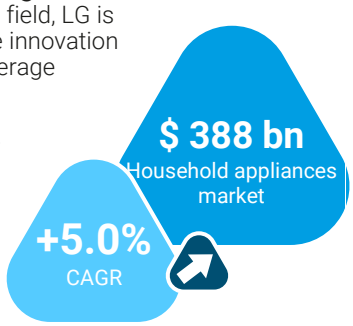


MARKET
INVESTMENTS AND ACTIVITY

What are the applicants doing?

Out of the three major players in this field, LG is the most innovative, with an average innovation score almost equal to the market average



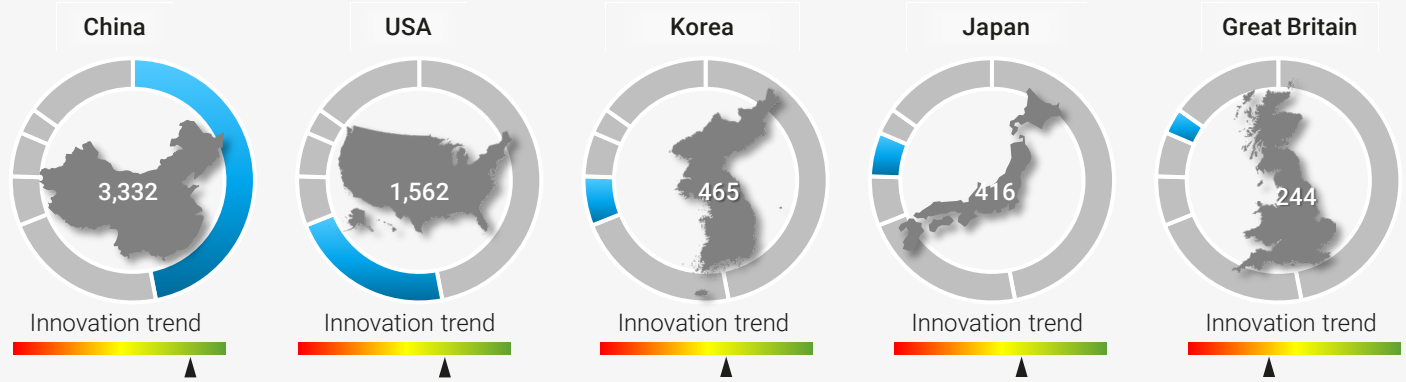


Right to repair

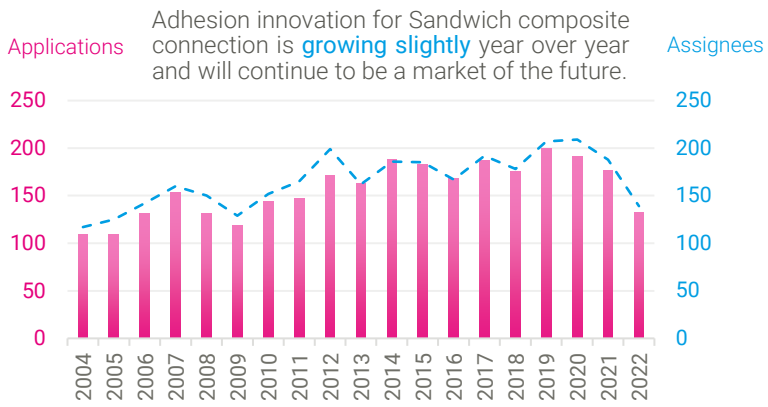
EU open new chances for growth

With an PAGR score almost twice as high as the CAGR score the industry seems to be driven by a high consumer orientation, mainly in the context of innovation. Due to the right to repair act, passed by the European parliament in April of 2024, the use of mechanical fasteners with non-losable sealing disks has become much more attractive. This is mostly owed to the fact, that these fastening methods can be replaced much more easily compared to adhesives and similar methods.

PATENT APPLICATIONS FOR FASTENERS (BY COUNTRY OF ORIGIN)



INNOVATION
TREND DEVELOPMENT



LG TAKES TO LEAD
TOP 5 KEY PLAYERS

LG #1 34 patents
SAMSUNG #2 28 patents
MIDEA #3 16 patents
TOYOTA #4 15 patents
STATE GRID #5 15 patents

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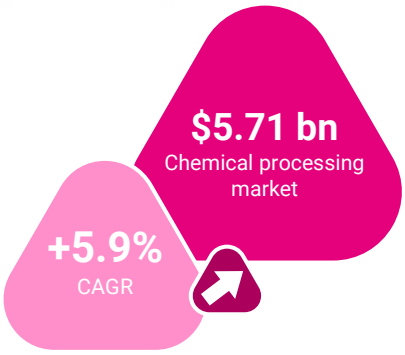
CHEMICAL PROCESSING

['kɛmɪkəl 'prəʊsɛsɪŋ]– ***noun***

In manufacturing, **chemical processing** refers to the transformation of raw materials into chemical products. Fasteners and washers are essential in ensuring secure, airtight seals in equipment like reactors, pipelines, and storage tanks, where preventing leaks and corrosion is critical.

Related: Corrosion resistance, Leak prevention, Material durability, Pipeline assembly, Safety standards, Sealing solutions



INNOVATION LANDSCAPE
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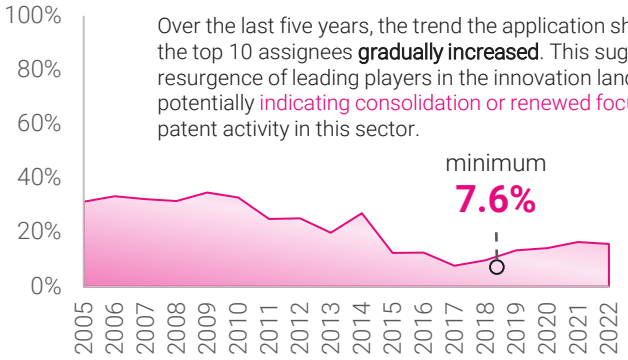
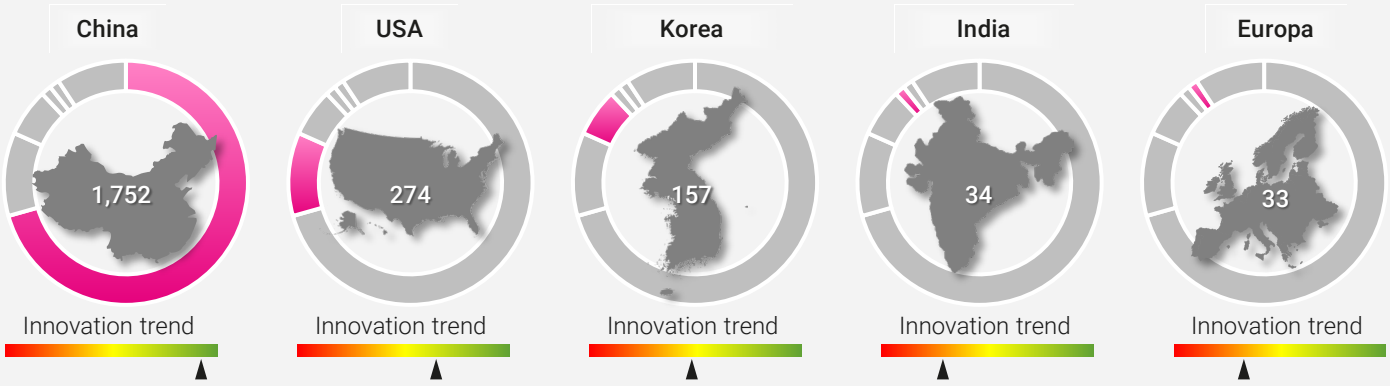


Over the last five years, the trend the application share of the top 10 assignees **gradually increased**. This suggests a resurgence of leading players in the innovation landscape, potentially indicating consolidation or renewed focus on patent activity in this sector.

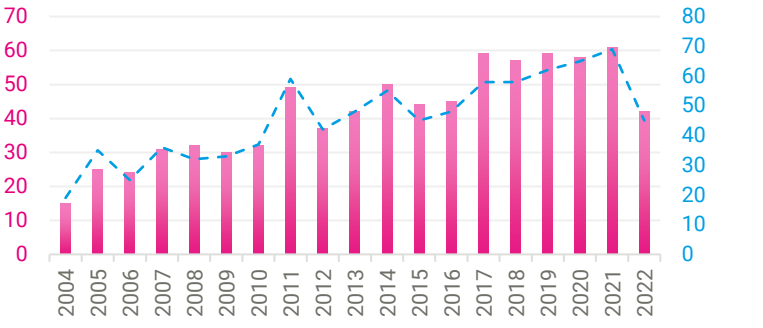
MATURE MARKET MOUNTING
INITIAL INVESTMENT BARRIER SLOWS MARKET GROWTH

Despite the high initial investment cost , the chemical processing market has performed better in the past 5 years than average industry growth rates. The PAGR indicator being comparable to the CAGR, with 0,4% deviation between the two, chemical processing seems to be an innovation driven market with effective commercialization and high innovation adoption rates.



INNOVATION
TREND DEVELOPMENT

Adhesion innovation for Sandwich composite connection is growing slightly year over year and will continue to be a market of the future.



SAMSUNG FAR IN THE LEAD
TOP 5 KEY PLAYERS

SINOPEC[1] #1 10 patents
SVF[2] #2 7 patents
HANWHA[3] #3 7 patents
PETROCHINA #4 6 patents
HYUNDAI #5 6 patents

1) China Petroleum and Chemical Corporation
2) Shanghai Valve Factory Co.,Ltd.
3) Daewoo Shipbuilding & Marine Engineering

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Königstraße 7 • D-01097 Dresden
Tel.: +49 (0)351 896 921 40
Fax: +49 (0)351 896 921 49
web: kontakt@white-ip.com
www.white-ip.com

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It is hereby certified that a European patent has been granted in respect of the invention described in the patent specification for the Contracting States designated in the specification.

Il est certifié par la présente qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet, pour les États contractants désignés dans le fascicule.

Europäisches Patent Nr.
European patent No.
Brevet européen n°

EP3956572

Tag der Bekanntmachung des Hinweises auf die Erteilung des europäischen Patents
Date of publication of the mention of the grant of the European patent
Date de la publication de la mention de la délivrance du brevet européen

22.03.2023

VERBINDUNGSEINHEIT UND VERFAHREN ZUR HERSTELLUNG EINER VERBINDUNGSEINHEIT

Patentinhaber | Proprietor(s) of the patent | Titulaire(s) du brevet

Schneider + Stahl Besitzunternehmen Gbr
Gewerbestraße 7
74214 Schöntal
DE

António Campinos

Präsident des Europäischen Patentamts | President of the European Patent Office | Président de l'Office européen des brevets

München, den | Munich, | Munich, le **22.03.2023**

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