Rauschert

Your Challenge.
Our Technology.

WELCOME

to Rauschert Norden AB!

Date: 29.11.2023

Cornelia F. Sundberg
CEO

Rauschert has:

- **> 125 years experience of Ceramics**
- **> 60 years experience of High-Performance Advanced Ceramics**
- **Competent staff with long experience and a broad know-how**
- **A wide range of ceramic materials**
- **An enormous range of ceramic products and solutions for many different applications and markets**

Rauschert Norden AB:

- **The Nordic company was founded middle of August 2023**
- **Rauschert Norden AB is responsible for the Nordic Countries and the Baltic States**
- **The Nordic office is located in Nacka, Stockholm**
- **Board members:**
  - Cornelia F. Sundberg
  - Diamantion Dias
  - Stefan Pfadenhauer
  - Rainer Rombach

Rauschert is an internationally operating technology company.

Company overview & mission

- **Independent company**
  - 12 production sites
  - Locations in 16 countries
  - Approx. 1.200 employees

- **Experience in manufacturing technical products made of ceramics (1898)**

- **Development of innovative B2B solutions in the areas of:**
  - Technical components
  - Mechanical engineering
  - Electro ceramics
  - High temperature fields
  - Energy technology
  - Consulting / Engineering

For and with technical partners Rauschert develops innovative products to jointly improve results and provides customer specific services worldwide.

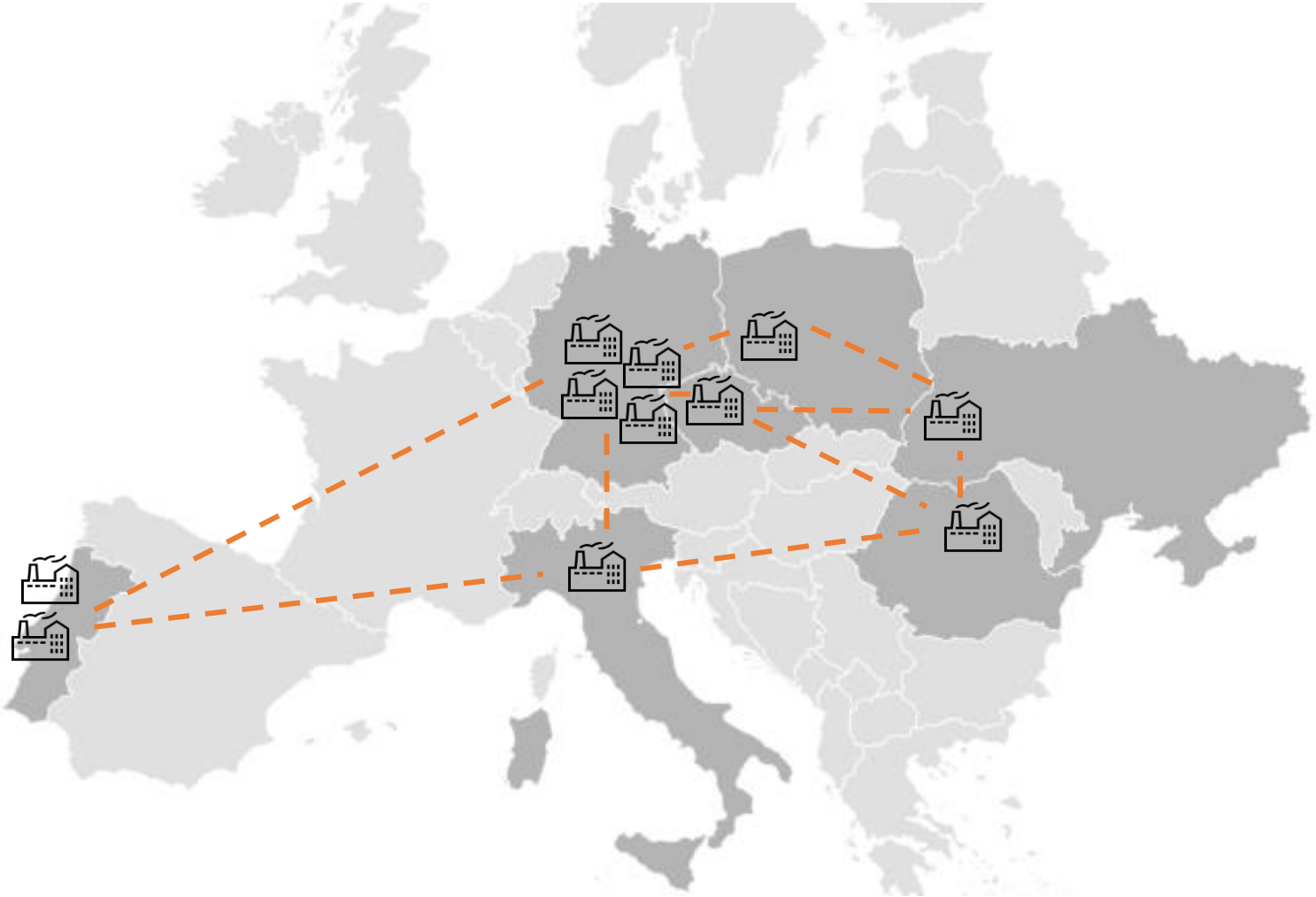
In year 2023 Rauschert celebrate 125 years!

*Research institutions and industrial companies with technically demanding products and long-term strategic orientation

The network of multiple production lines offers safety and flexibility.

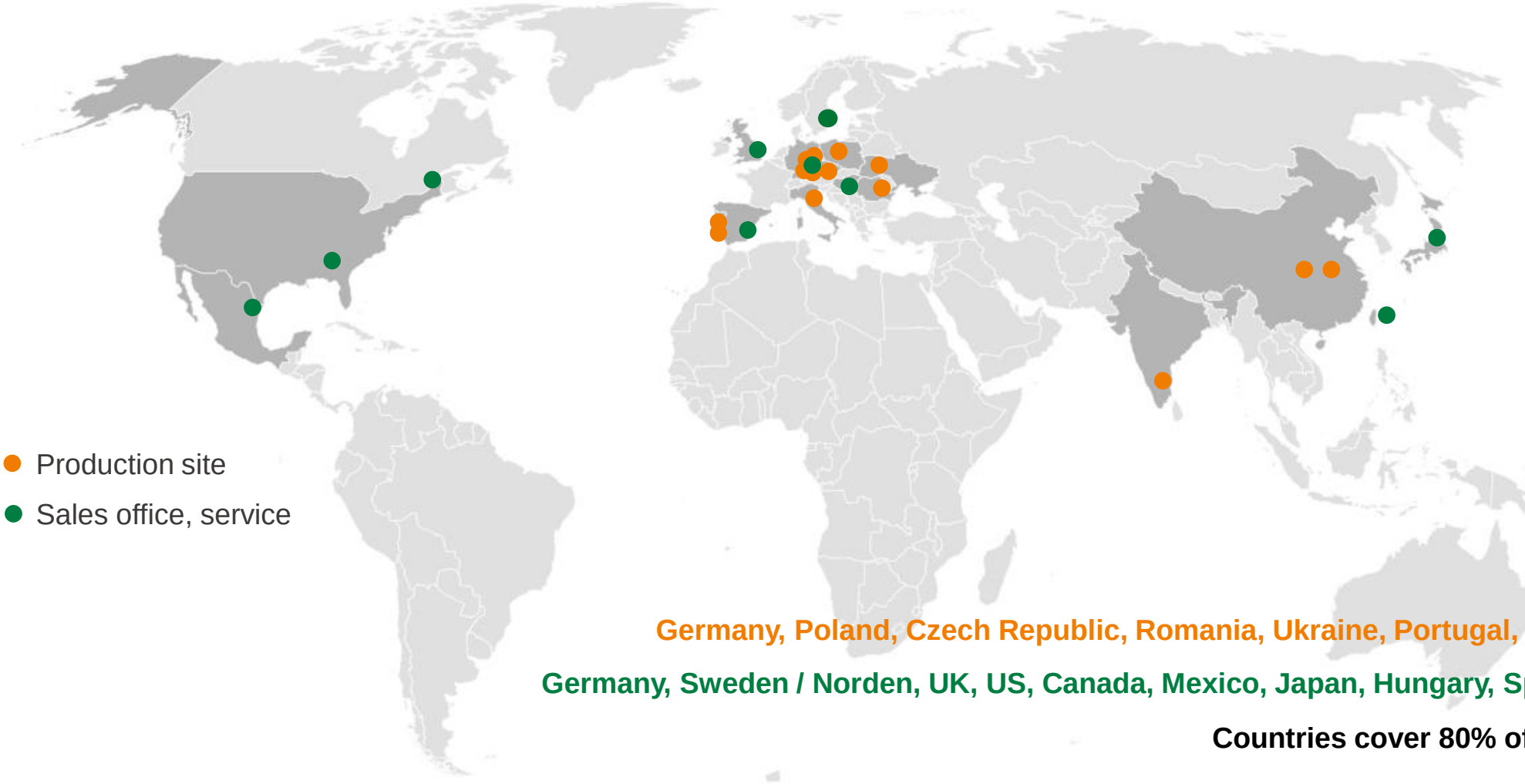
Powerful manufacturing network

Production sites



Rauschert has a global presence with further production sites and trading companies.

International presence for customers worldwide



- Production site
- Sales office, service

Germany, Poland, Czech Republic, Romania, Ukraine, Portugal, India, China

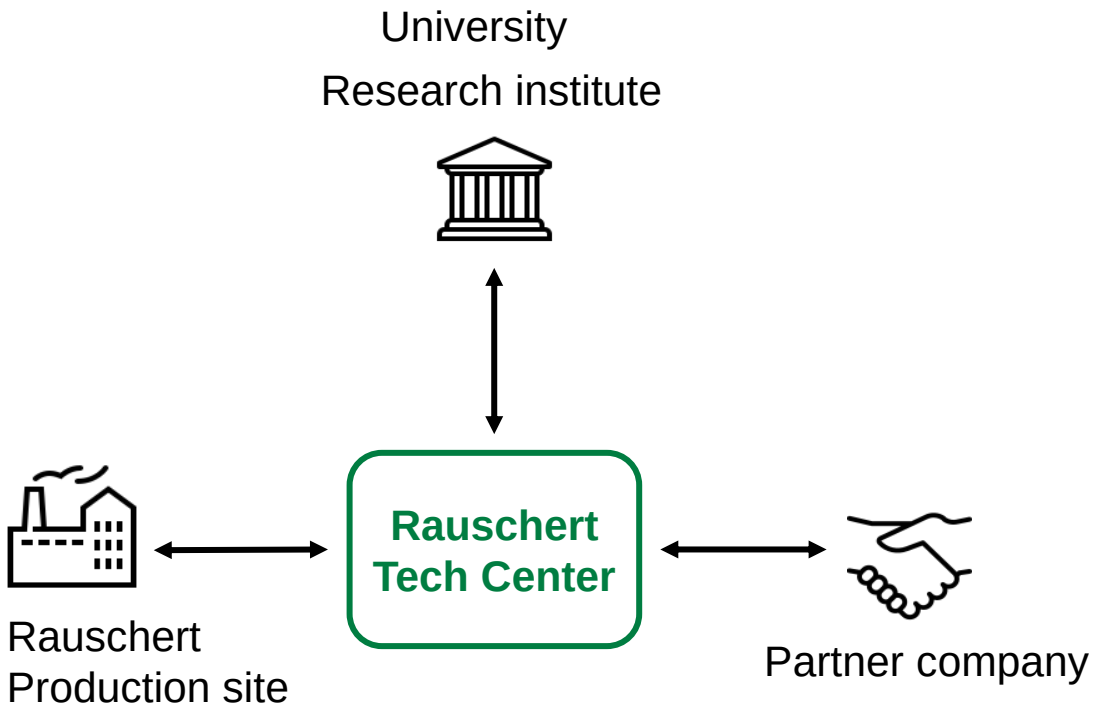
Germany, Sweden / Norden, UK, US, Canada, Mexico, Japan, Hungary, Spain, Taiwan

Countries cover 80% of global GDP

The Rauschert TechCenters organise the technical partners' network.

Tech Center concept

- Supporting scientific work
- Recruitment / development of specialists and managers
- Organization of funded collaborative projects
- Use of partners' infrastructure / equipment
- Joint product and technology development
- Tech Center Nuremberg at TH Nuremberg, Tech Center Bayreuth at the University of Bayreuth,
- Tech Center Wuppertal at RWTH Aachen University
- New: Tech Center Dresden



Rauschert is currently working on about 50 funded joint projects. A selection of our partners:

Scientific partners & projects

Fraunhofer IKTS IIS IISB ISE ISC/HTL IST

Neue Materialien Bayreuth

CEITEC Central European Institute of Technology BRNO | CZECH REPUBLIC

Georg-Simon-Ohm Technische Hochschule Nürnberg

Silesian University of Technology

Universität Bayreuth

HI ERN Helmholtz Institute Erlangen-Nürnberg

UCONN University of Connecticut

BRNO University of Technology

RWTH Aachen University

Jülich Forschungszentrum

TTRI Taiwan Textile Research Institute

VZÚ Plzeň

TÉCNICO LISBOA

Hochschule Coburg

Ceramic Materials Engineering Lehrstuhl Keramische Werkstoffe

Natural Resources Canada

hochschule hof University of Applied Sciences

DITF Deutsche Institute für Textil+Faserforschung

ISAT Institut für Sensor- und Aktortechnik

National University Lviv Polytechnic

universidade de aveiro

Extended Applications List / Photos for Rauschert Ceramics Industries


Chemical industry


Oil & Gas


Renewable energies


Medical production


Food processing


Medical treatment


Textile industry

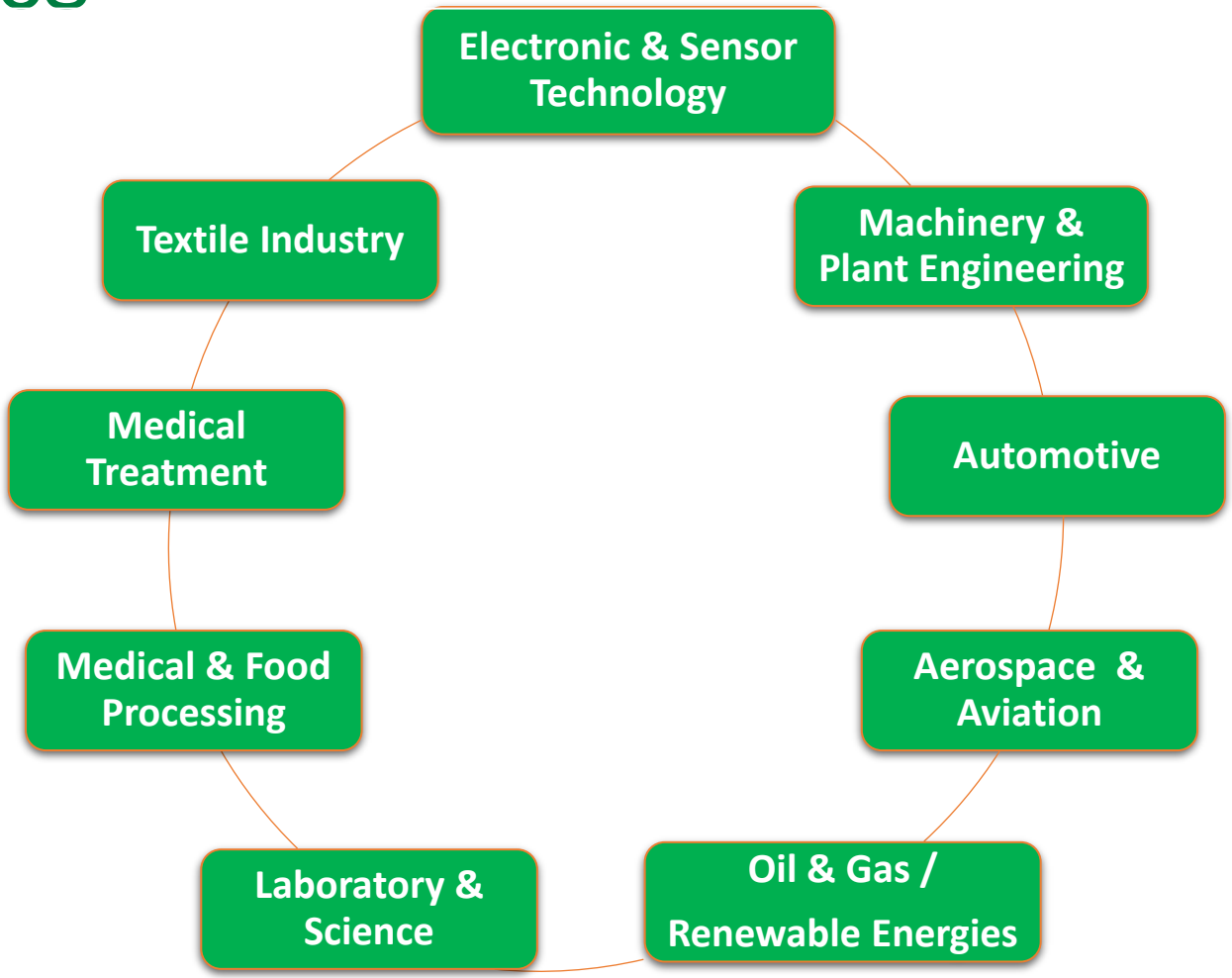

High temperature


Metal work


Aerospace & Aviation

Engineering Ceramics

- **Rauschert are engaged in many fields of applications.**
- **Our High-Performance Ceramic products have:**
  - Extremely high corrosion resistance
  - Excellent erosion and abrasion resistance
  - High temperature resistance up to 1.900 ºC
  - Very good sliding properties
  - FDA certificates (Food & Drugs Approval)



Rauschert offers a comprehensive range of materials

Ceramic Materials

		Strength	Temperature resistance	Chemical resistance	Special features
Oxide Ceramics	**Aluminium Oxide**	●●●●	●●●●	●●●●	High hardness Metallic coating possible
	Zirconium Oxide	●●●	●●●	●●●	High mechanical strength
	ZTA / ATZ	●●●	●●●	●●●	High mechanical strength
	Magnesium Oxide		●●●	●	High thermal conductivity
	Titanium Oxide	●●	●	●	Smooth surface
	Aluminium Titanate		●●●	●	Good thermal shock resistance
Non-Oxide Ceramics	**Silicon Nitride**	●●●	●●●●	●●	High strength Good thermal shock resistance
	Silicon Carbide	●●●●	●●●●	●●●●	High hardness
Silicate Ceramics	**Steatite**	●●	●●	●	Good electrical insulation
	Cordierite	●	●●	●	Good thermal shock resistance
	Mullite	●●	●●	●●	Low cost material with good mechanical strength
	Zirconium Silicate	●	●●	●	Good thermal shock resistance
	Porcelain	●	●	●	Low cost material

Aluminum oxide materials

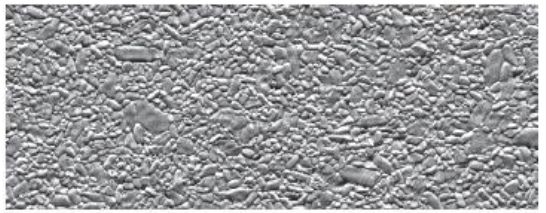
Ceramic Materials

Physical Properties

Material according to DIN EN 60672	RAPAL®300 C 799	RAPAL®200 C 799	RAPAL® 100 C 799	RAPAL® C 795	RAPOX® C 795	Rapal light C 795
Aluminium oxide %	99.9	99.7	99.7	98.0	95.0	95.0
Colour	ivory	white	white/red	white/red	white/brown	white
Density g / cm^3	> 3.95	> 3.85	≥ 3.85	3.70	3.75	3.70
Porosity %	0	0	0	0	0	0
Flexural strength MPa	400		300	240	230	230
Young's modulus GPa	380	380	380	350	320	
Hardness Vickers (depending on the shape) HV 0.1	1900-2300	1800-2300	1700-2300	1500	1500	1500
Withstand voltage U kV	20	20	20	18	–	–
Volume resistivity at Alternating voltage Ω cm	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}	10^{12}
Coefficient of linear expansion 10^{-6} K^{-1} between 20 ... 1000 °C	9	9	9	8.5	8	8
Thermal conductivity $\frac{W}{m \cdot k}$ 30 - 100 °C	19 - 30	19 - 30	19 - 30	16 - 25	15 - 25	16 - 25

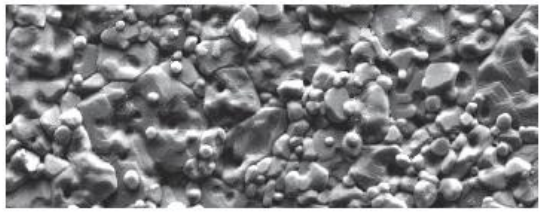
Surface characteristics

RAPAL® 300 natural surface 30 µm



RAPAL® 200 natural surface 30 µm

RAPAL® 100 natural surface 30 µm



Aluminium oxide RAPAL® is an oxide ceramic material based on high purity alumina. By sintering specifically developed powders at high temperatures, a dense ceramic material approaching diamond hardness can be created.

The values are typical material properties and may vary according to products configuration and manufacturing process.

For more details please feek free to contact us: info@rauschert-se.com

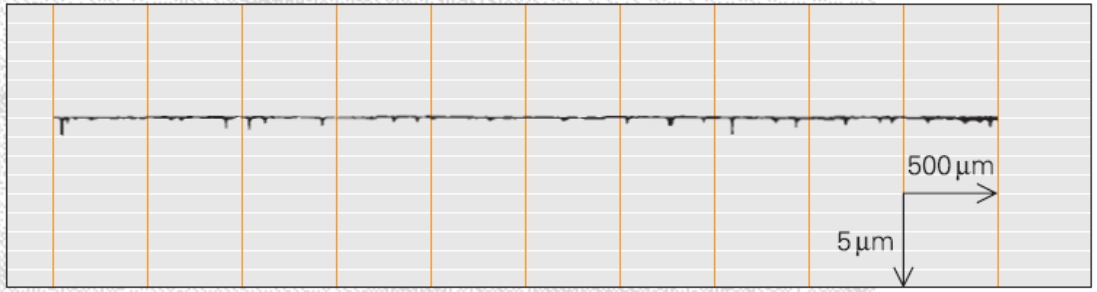
Zirconium oxide materials

Ceramic Materials

Physical Characteristics

		Zirconia M Mg-PSZ	Zirconia Y Y-TZP
Content of zirconium oxide	%	96	95
Content of magnesium oxide	%	4	-
Content of yttrium oxide	%	-	5
Density	g/cm^3	5,5	> 5,85
Colour		yellow	white
Porosity	%	0	0
Thermal conductivity	W/m · K	2,3...2,6	2,5
Hardness acc. to Mohs	MH	7	7
Coefficient of linear expansion (20...1000° C)	1/K	$6,5 \cdot 10^{-6}$	11
Flexural strength	N/mm^2	400	800
Volume resistivity	Ω · cm	10^{11}	10^{11}

Surface Characteristics



Ra = 0,03 – 0,04 µm (surface diagram).

Zirconium oxide has outstanding properties due to the stabilizing additives of Magnesia and Yttria.
During the sintering process an extremely fine crystalline structure is obtained. This structure is giving it very high toughness, bending and tensile strength. A very smooth surface finish can be obtained by polishing, which gives a very low coefficient of friction.

The values are typical material properties and may vary according to products configuration and manufacturing process.

For more details please feek free to contact us: info@rauschert-se.com

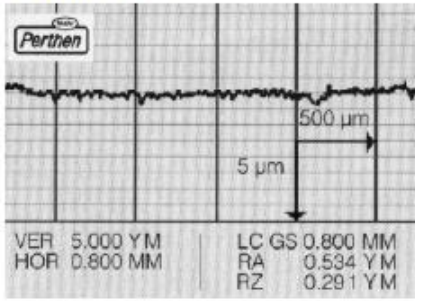
ZTA materials

Ceramic Materials

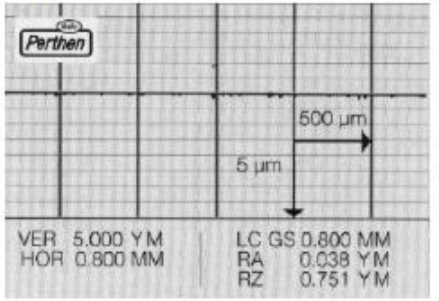
Physical Characteristics	RAPAL® 200 AZ	RAPAL® 200	RAPAL® 300	Zirconia M	Zirconia Y	Titania	Titania C
Content of alumina %	84	99,7	99,9	--	--	--	--
Content of zirconia %	15	--	--	96	94.5	--	--
Content of titania %	--	--	--	--	--	92	92
Density g/cm³	4.1	3.9	> 3.95	5.70	6.00	4,05	4,05
Colour	white	white	ivory	yellow	white	yellow	black
Porosity %	0	0	0	0	0	0	0
Thermal conductivity $\frac{W}{m \cdot K}$ 20 - 100 °C	19-30	19-30	19-30	2.0	2.5	2.5	2.5
Hardness HV 100	1600	1800-2000	~~1100~~	1100	1400	1100	1100
Coefficient of linear expansion $10^{-6}\ K^{-1}$	9	9	9	10	11	8.5	8.5
Flexural strength N / mm²	400	300	400	400	800	70	70
Volume resistivity Ωcm	10^{10}	$5 \cdot 10^{14}$	10^{14}	10^{11}	10^{11}	10^{10}	$5 \cdot 10^{6}$

Surface Characteristics

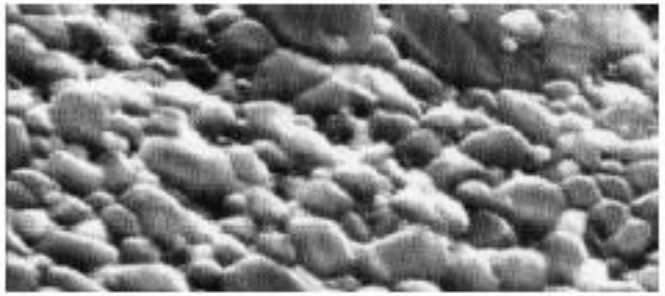
Natural surface



Polished surface



SEM (— — 10 µm)



RAPAL® 200 AZ is a composite of alumina and zirconia.

The proportion of 15 wt-% ZrO2 causes a significant increase in strength and fracture toughness compared with pure alumina.

The values are typical material properties and may vary according to products configuration and manufacturing process.

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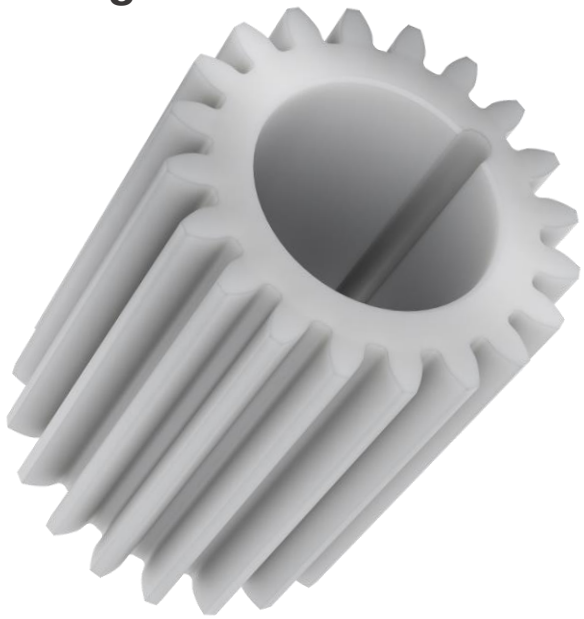
Mechanical Engineering Ceramics

High-performance ceramic engineering components from Rauschert meet the requirements of demanding industries!



Mechanical Engineering Ceramics
High Pressure Pistons

- **High-performance ceramic pistons for demanding pump applications:**
- High pressure Pistons for Water Jet Cutting machines withstands pressure up to 6 000 – 10 000 bar

  - **Requirements:**
  - Corrosion resistance
  - Very good friction values between piston surface and
  - Excellent strength values of ceramic to metal interface
  - Highest pressure resistance
  - Low Ra value < 0.1 micron
  - Highest service life of seal due to perfect surface finish

Materials:

- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Aluminium Oxide Al_2O_3**
- **Aluminium Oxide ZTA**

Mechanical Engineering Ceramics
Piston and Cylinder Units

- **High-performance ceramic piston and cylinder units for seal less pumps:**

Requirements:

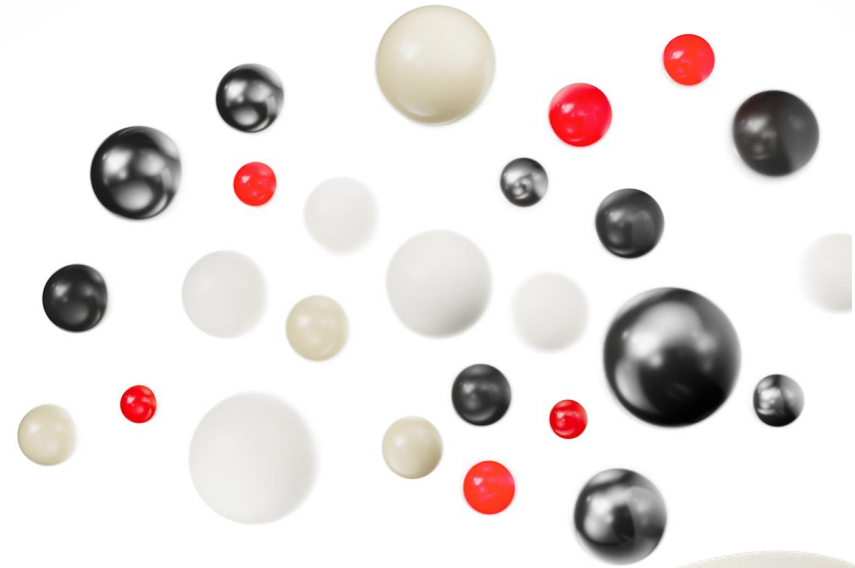
- Very good friction values between piston and cylinder
- Excellent corrosion, abrasion and erosion resistance
- Low Ra value
- Piston and cylinder fits together with a gap of 2 – 5 microns
- Additional sealing elements are not necessary
- Highest service life due to perfect surface finish

Materials:

- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Aluminium Oxide Al_2O_3**
- **Zirconia Toughened Alumina ZTA**

Mechanical Engineering Ceramics
Valve parts

- **High-performance ceramic valve seat balls :**



Requirements:

- Very good friction values between ball and cylinder
- Excellent corrosion, abrasion and erosion resistance
- Perfect fit
- Highest service life due to perfect surface finish

Materials:

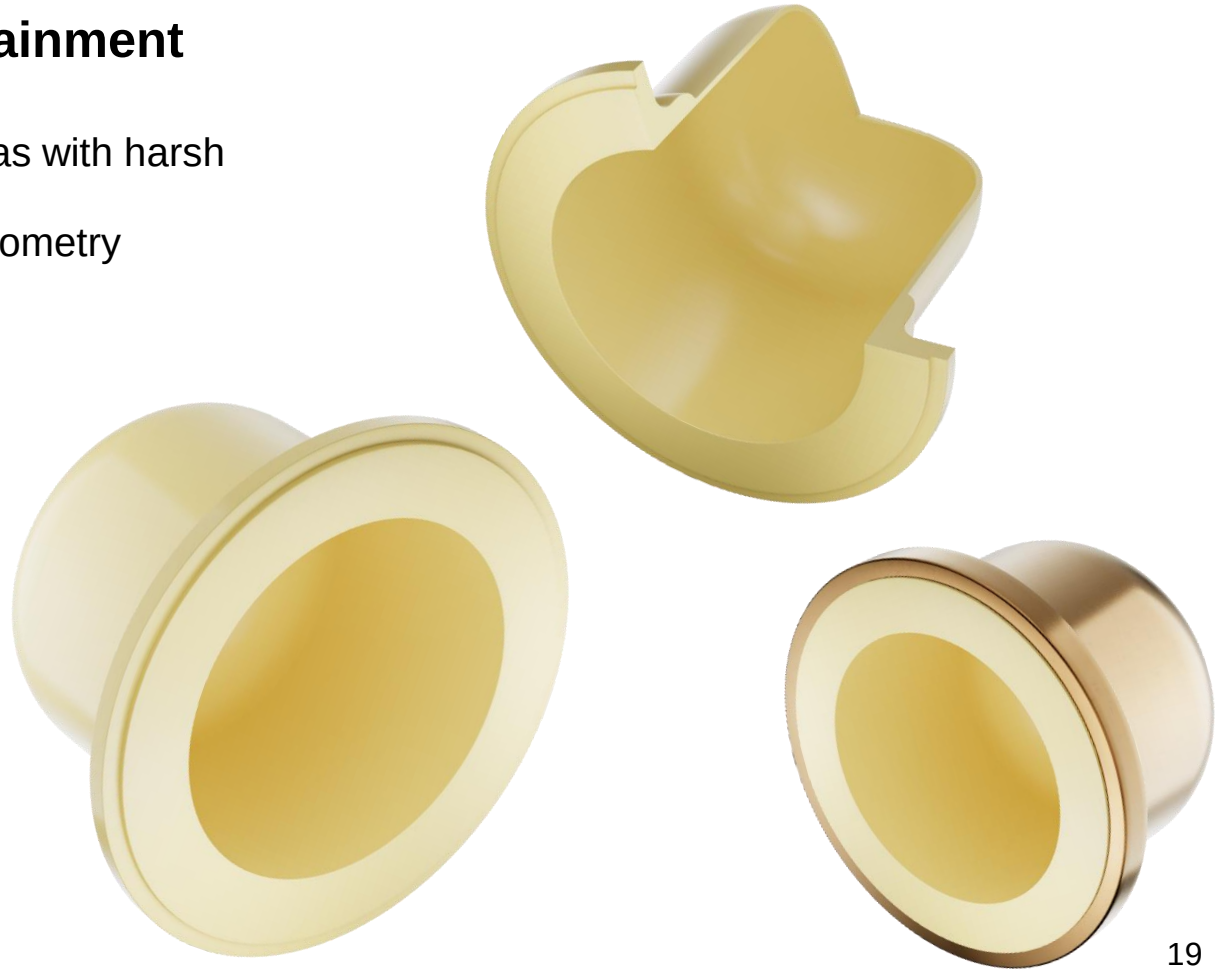
- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Aluminium Oxide Al_2O_3**
- **Zirconia Toughened Alumina ZTA**
- **Alumina Toughened Zirconia ATZ**
- **Silicon Nitride Si3N4**
- **Ruby**

Mechanical Engineering Ceramics
Pressure Containment Shells (Spacer Cans)

- **High-performance ceramic Pressure Containment Shells for demanding pump applications:**
  - Used for magnet driven pumps for chemical, oil & gas with harsh environment
  - Successfully tested up to >700 bar with a correct geometry

  Requirements:
  - Abrasion, erosion and corrosion resistant
  - Non-magnetizable
  - No eddy current
  - No heating-up
  - High energy efficiency
  - Corrosion resistance
  - High compressive strength

  Materials:
  - **Zirconium Oxide ZrO_2 – Mg-PSZ**

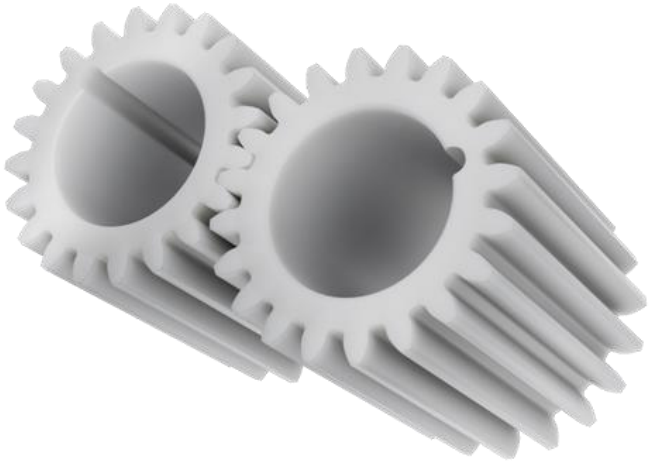


Mechanical Engineering Ceramics
Wear parts for harsh environment

- **High-performance ceramic Wear Parts for demanding industries and harsh environment:**
  - Used for industries like chemical processes, mining, milling, mixing and oil & gas etc.
- **Requirements:**
  - Tight tolerances
  - Low Ra-Value
  - Abrasion & erosion resistance
  - Corrosion resistance
  - High compressive strength
  - Complicated geometries allowed
  - Customized production

Materials:

- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Zirconium Oxide ZrO_2 – Y-TPZ**
- **Silicon Nitride Si_3N_4**



Mechanical Engineering Ceramics Mining & Milling:

- **Machine Components for harsh environment:**
  - Sleeves
  - Bushings
  - Gear wheels

  Materials:
  - **Silicon Carbide SSiC**
  - **Silicon Nitride Si_3N_4**
  - **Zirconium Oxide ZrO_2 - Y-TZP**
  - **Zirconium Oxide ZrO_2 - Mg - PSZ**

Mechanical Engineering Ceramics
Accurate Nozzles

- **High-performance ceramic nozzles for demanding industries and harsh environment:**
  - Used for example in chemical processes, oil & gas applications, food processing and medical production
  - **Requirements:**
  - Tight tolerances
  - Low Ra-Value
  - Abrasion, erosion & corrosion resistance
  - High compressive strength
  - Complicated geometries allowed
  - Customized production

  Materials:

  - **Zirconia Toughened Alumina ZTA**
  - **Zirconium Oxide ZrO_2 – Mg-PSZ**
  - **Zirconium Oxide ZrO_2 – Y-TPZ**
  - **Silicon Nitride Si_3N_4**

Mechanical Engineering Ceramics
Slide Bearings

- **High-performance ceramic bearings with tight tolerances and best surface roughness:**
  - Used for example in chemical processes, oil & gas applications, food processing and medical production
  - **Requirements:**
  - Tight tolerances
  - Best / Low Ra-Value ≤ 0,1 Micron
  - Excellent abrasion, erosion and corrosion resistance
  - Complicated geometries allowed
  - Customized production
  - FDA conform

Materials:

- **Zirconia Toughened Alumina ZTA**
- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Zirconium Oxide ZrO_2 – Y-TPZ**
- **Silicon Carbide SSiC**
- **Silicon Nitride Si_3N_4**

Mechanical Engineering Ceramics Rolling Bearings

- **High-performance ceramics are designated materials especially for ball & roller bearings applications with high demand in critical applications:**
  - Used for example in chemical processes, oil & gas applications, food processing and medical production.

Full ceramic bearings:

- Both rings and rolling elements are made of ceramic materials ZrO_2 and/or Si_3N_4.
- These high-performance ceramics materials have outstanding material properties compared with conventional bearing steels.

Hybrid bearings:

- Rings are made of standard (or special) bearing steels, rolling elements are made of ceramic materials.
- Physical characteristics of high-performance ceramic materials in combination with (special) bearing steel enable extraordinary performance in hybrid bearings**.**

Materials:

- **Zirconium Oxide ZrO_2 – Y-TPZ**
- **Silicon Nitride Si_3N_4**

Mechanical Engineering Ceramics
Welding & Positioning Pins for Welding processes

- **High-performance ceramics are designated materials for parts used in welding processes:**
- **Ceramic Welding Pins are used for Welding of:**
  - Screws-nuts
  - Bolts
  - Screws
  - Etc.
- **For example:**
  - Measurement and calibration of holes
  - Positioning of metal sheets
  - Spot welding
- All these advantages can be reached within the automotive industry or sheet metal works.

Materials:

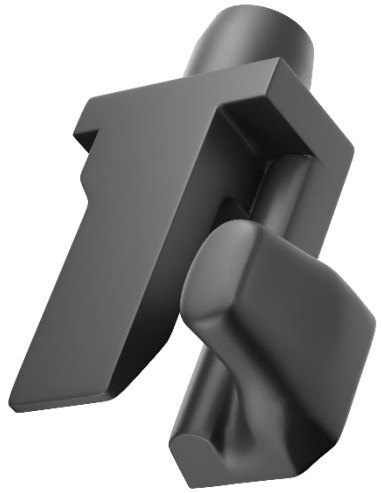
- **Zirconium Oxide ZrO_2 – Y-TPZ**
- **Silicon Nitride Si_3N_4**

Mechanical Engineering Ceramics
Textile Industry

- **High-performance ceramic thread guides, yarn guides, bobbin rollers and other customized parts for advanced modern textile machines:**
  - Translucent ceramics
  - DTY Components
  - Twist Stoppers
  - Rapaltex friction discs
  - TiO2 Components
  - POY components
  - Entrance thread guide texturing units (patent pending)
  - Godet rolls
  - Customized production

Materials:

- **Zirconia Toughened Alumina ZTA**
- **Zirconium Oxide ZrO_2 – Mg-PSZ**
- **Zirconium Oxide ZrO_2 – Y-TPZ**
- **Titanium Dioxide TiO_2**



Electrical Engineering Ceramics
Ceramic-to-Metal Assemblies

- **Ceramic-to-metal assemblies:**
  - Feedthroughs
  - Laser nozzle holders
  - Flow meters
  - Sensor components
  - Insulators for UHV applications
  - Insulators for RF applications
  - Vacuum chambers
  - Customized feedthroughs
  - Special parts and applications on request

Materials:

- **Aluminum Oxide Al_2O_3 - 99,7 %**
- **Zirconium Oxide ZrO_2 - Mg-PSZ**
- **Various soldering and braze materials**
- **Various metals depending on application**

Electrical Engineering Ceramics Feedthroughs and other Components

- **High-performance ceramic accurate flow meters for chemical industry, oil & gas industry renewable energies, food processing and medical production etc:**

  - **Product selection:**
  - Vacuum feedthroughs
  - High pressure feedthroughs
  - RF-/HF- application for X-ray generation
  - Nozzle holder for cutting and welding laser devices
  - Ring insulator for insulation component for accelerator technologies
  - Vacuum chambers
  - Component for HF-welding devices e.g. for polymeres (bags for blood preservation)

  Materials:
  - **Aluminum Oxide Al_2O_3 - 99,7 %**
  - **Zirconium Oxide ZrO_2 - Mg-PSZ**
  - **Zirconia Toughened Alumina ZTA**
  - **Steatite C221**
  - **Various braze metals depending on application parameters**

Electrical Engineering Ceramics
Flow meters & Level Gauging

- **High-performance ceramic accurate flow meters for oil & gas industry renewable energies, food processing and medical production etc.:**

  Requirements:
  - Tightness
  - Internal pressure resistance
  - Wear resistance
  - Thermal shock resistance
  - Corrosion resistance
  - Conformity with Pressure Equipment Directive
  - FDA Conform

  Materials:
  - **Aluminum Oxide Al_2O_3 - 99,7 %**
  - **Zirconium Oxide ZrO_2 - Mg-PSZ**
  - **Zirconia Toughened Alumina ZTA**
  - **Various braze metals depending on application parameters**

Electrical Engineering Ceramics
Flow meters and level gauging instruments

- **High-performance ceramic accurate flow meters for chemical industry, oil & gas industry renewable energies, food processing and medical production etc:**

Possible measurement principles system:

- Magnetic Inductive Flow metering
- Capacitive Level Gauging
- Conductive Measurement
- Microwave / Radar Level Gauging Sensors
- Pressure Sensors
- Oxygen Measurement Sensors

Materials:

- **Aluminum Oxide Al_2O_3 99,7 %**
- **Zirconium Oxide ZrO_2 Mg-PSZ**
- **Zirconia Toughened Alumina ZTA**
- **Various braze metals depending on application parameters**

High-performance components from Rauschert meet the requirements of demanding industries.

High Temperature Field:

- **High Temperature resistance products and materials used for:**
  - Thermocouple tubes
  - Ceramic tubes both open
  - Special tubes
  - Insulators
  - Discs
  - Plates
  - Etc.

Materials:

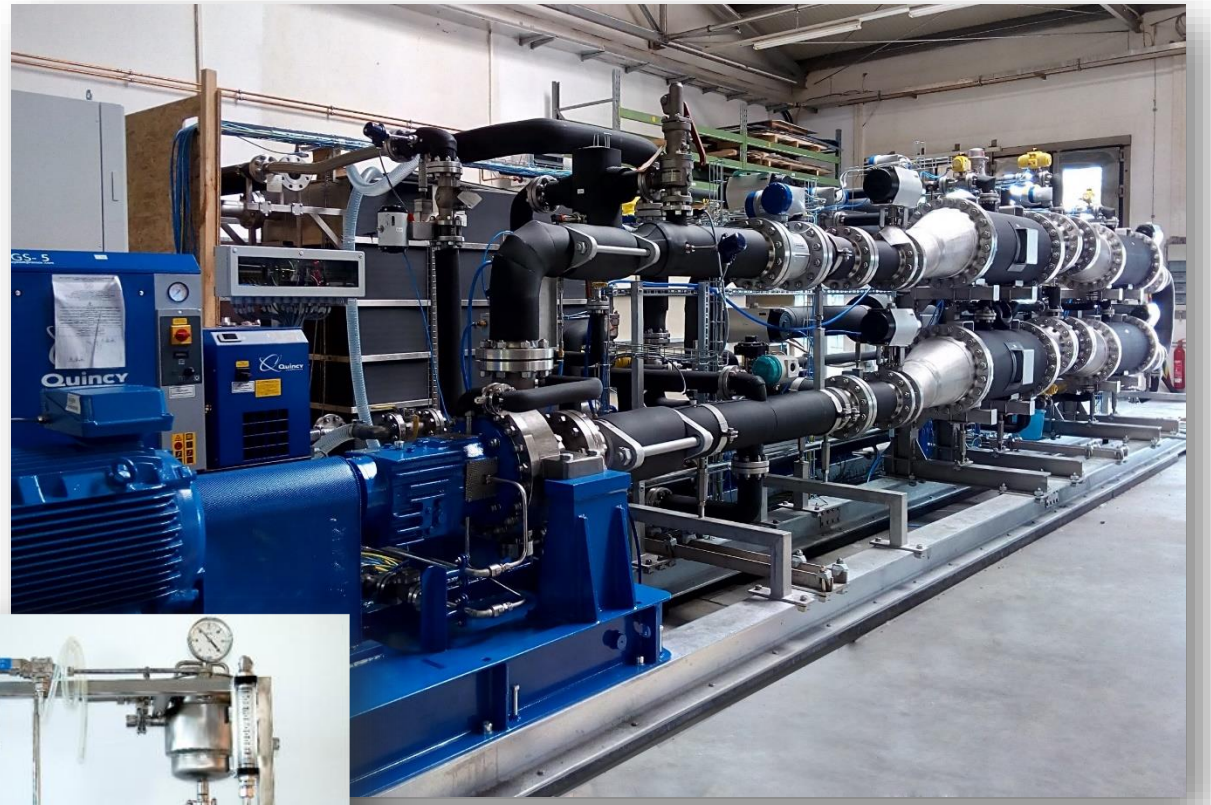
- **Aluminium Oxide Al_2O_3 - 99,7 %**
- **Alumina C620**
- **Steatit C221**
- **Other materials on request**

The innovative inopor® Filtration Technology - developed together with the Fraunhofer Institute IKTS.

- **Advantages of ceramic filtration**
  - Wear resistant to high temperatures, acids, bacteria, hard particles
  - Long service life
  - Cleaning by pressure backwashing or steam sterilization possible
  - Dry storage possible
  - High permeate flow
- **Services**
  - Filtration membranes and modules
  - Application laboratory
  - Pilot plants
- **Exemplary applications**
  - Pharmacy / Biotechnology
  - Food
  - Special wastewater
  - Oil & gas industry

Joint venture FTRJ GmbH is part of the Rauschert Group for Filtration Systems

- Planning and building of ready-to-use filtration plants with ceramic/polymer membranes.
- Removal of oil and dyes in the textile industry
- Filtration of beverages (milk, beer, wine, fruit juice)
- Treatment of process water for oil sands extraction, Alberta/Canada



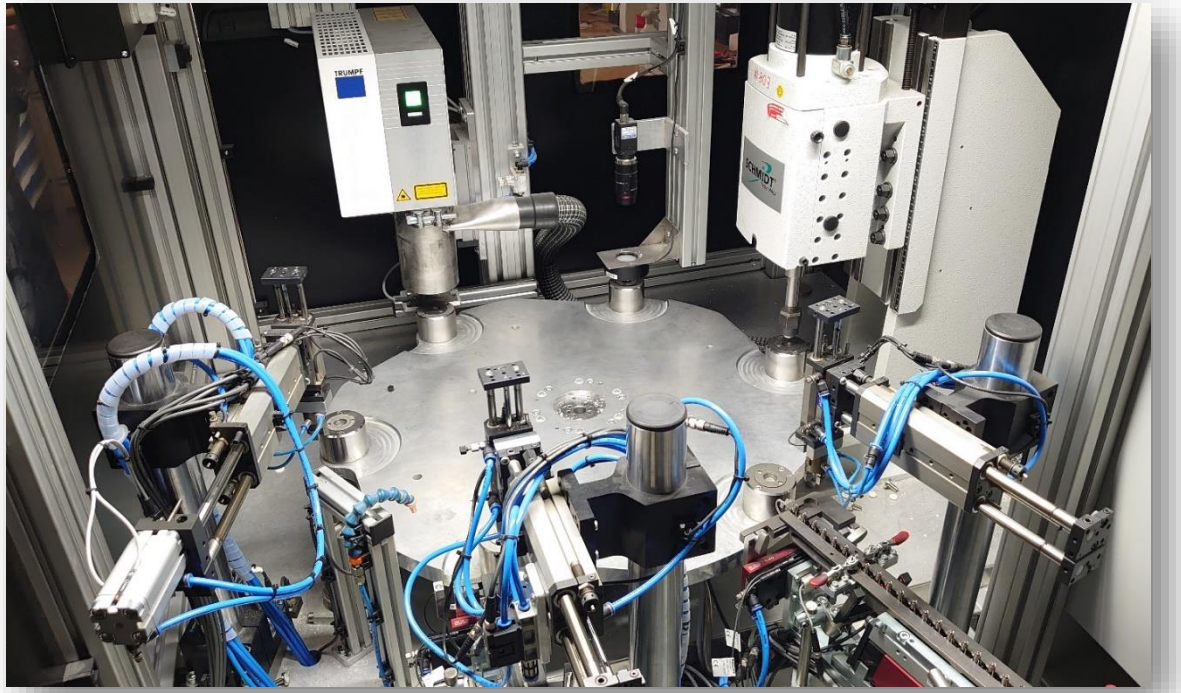
FTRJ

Andreas Junghans Filtration Technology®

Rauschert develops, produces and trades in complex tools, appliances and special machines.

Engineering

- Special machines
  - Automation / Robotics
  - Machines for ceramic production
  - Filtration systems
- Appliances
  - Measuring and sorting devices
  - Handling systems and assembly workstations
  - Controls / Programming
- Tools
- PV systems (10 MWP own systems)



Rauschert manufactures electrotechnical components of high quality as standard

Energy technology

- Fuse bodies and material
- Thermocouple protection tubes
- Spark chambers
- Crushable ceramics
- Infrared radiator panels

Rauschert produces technical ceramics with a focus on mechanical engineering applications.

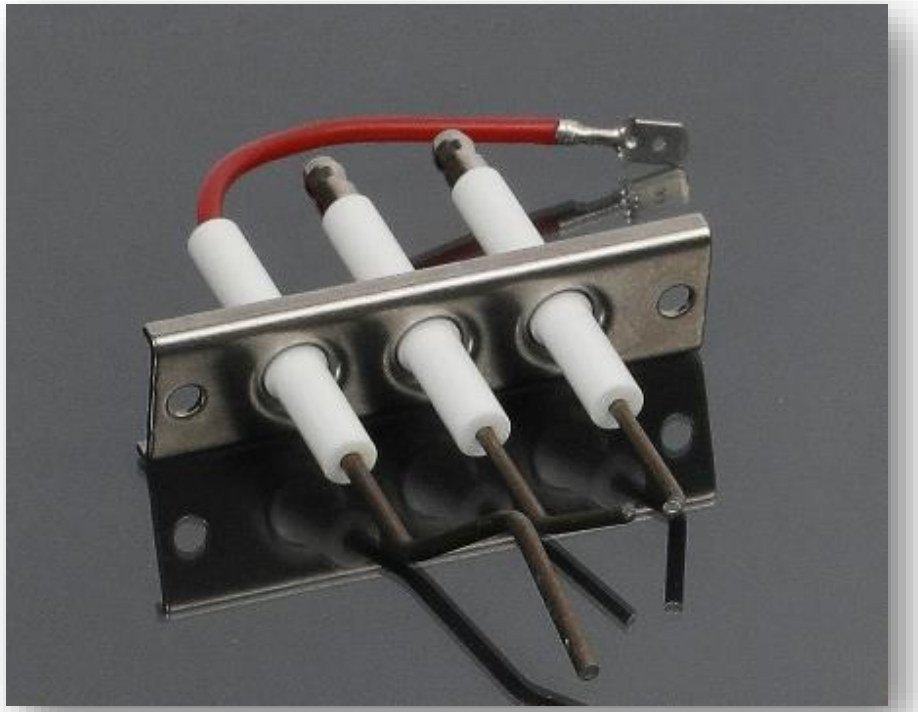
Technical Ceramics

- Fluid handling components
- Pump components
- Ceramics membranes
- Wire/Cable guides
- Fuse bodies

- MgO heater components
- Honeycombs
- Ceramic spheres
- Kiln furniture
- Foundry technology
- High temperature measurement
- Tool inserts

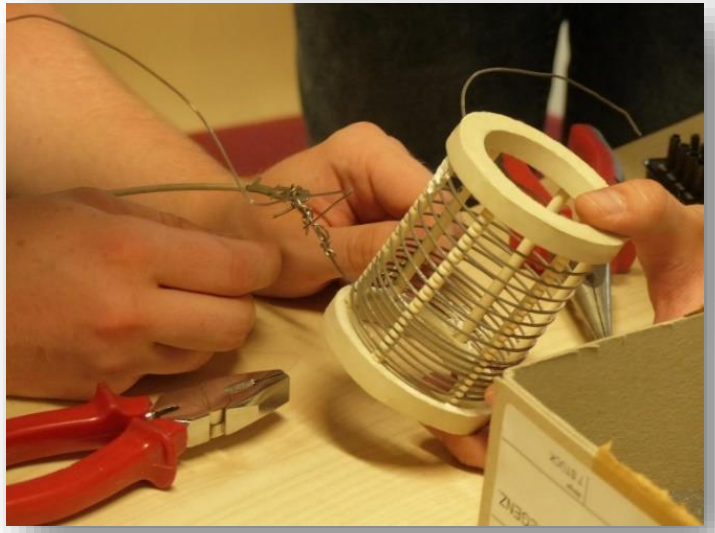
Ignition / heating systems

- **Rauschert is one of the leading manufacturers of ignition and heating systems worldwide:**
  - Ignition/monitoring electrodes with plug connectors
  - Ignition/monitoring electrodes with cables
  - Ignition leads and connection cables
  - High temperature heating elements / hot surface ignitors



MoonFibre project

- **Rauschert develops and manufactures customised technical components beyond traditional standards**
  - Customer: AIX2SPACE (student research group at RWTH Aachen University; as part of a sponsorship).
  - Production of rings made of cordierite as well as slotted ceramic rods and thermocouple protection tubes made of aluminium oxide
  - Use in the prototype of a spinning plant for the production of glass fibers from moon rocks



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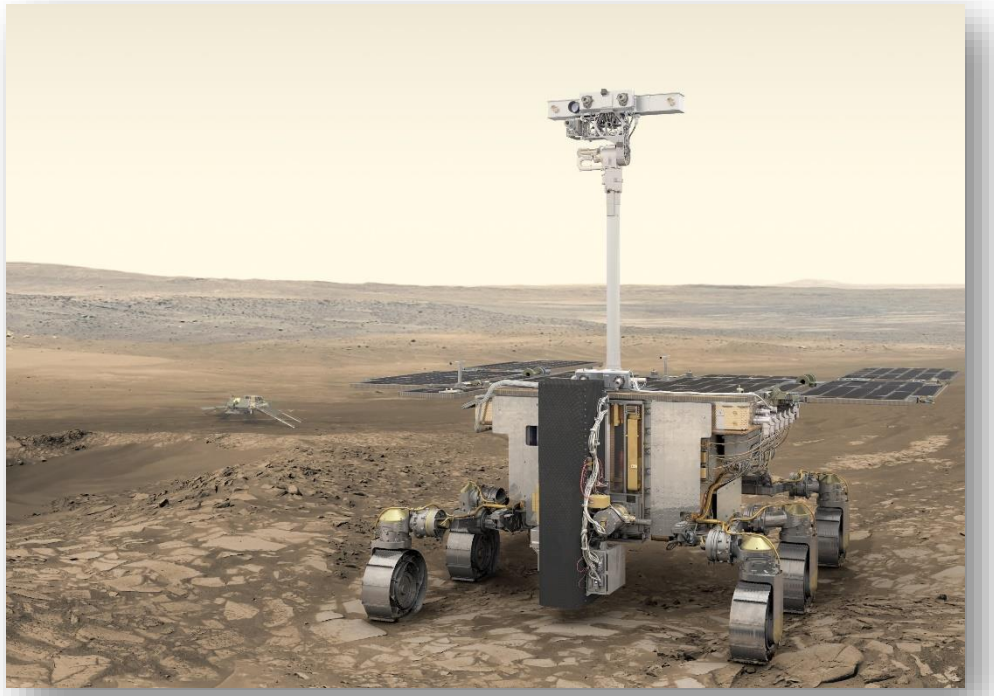
ExoMars project

- **Rauschert develops and manufactures customised technical components beyond traditional standards:**
  - Customer: Max Planck Institute for Solar System Exploration
  - Production of micro kilns to prepare samples for gas chromatography
  - Micro kilns are part of “ ExoMars Rover ” 2024



Rauschert offers in addition ceramic coatings on metal parts.

Standard APS Ceramic Coatings

- Aluminium Oxide Al_2O_3
- Aluminium Oxide Al_2O_3 / Titanium Oxide TiO_2
- Chromium Oxide Cr_2O_3
- Zirconium Oxide ZrO_2 Mg-PSZ
- Zirconium Oxide ZrO_2 Y-TZP
- Calcium Oxide CaO / Zirconium Oxide ZrO_2 - Mg-PSZ

Typical coating thickness 100 - 400 microns

The range of services is completed by special products in metal processing.

Ceramic coatings

- Moulded parts and coatings (APS, HVOF)(chromium oxide, aluminium oxide, titanium oxide)
- Series production (stamping, pressing) and individual precision production
- Laser processing and surface optimisation

.

Rauschert Energy Management System

Heinersdorf

- **Energy at Rauschert is innovative and sustainable**
- **Approx. 10 MWP own PV output**

Veilsdorf

Aim: Independent energy supply with green electricity and thus CO_2 neutrality.

Photovoltaic installations

New warehouses

- Installed PV capacity at Rauschert: approx. 10 MWP
- The electricity generated is sufficient to supply approx. 3,000 single-family households.
- Continuous planning of further installations at all locations

Existing roofs

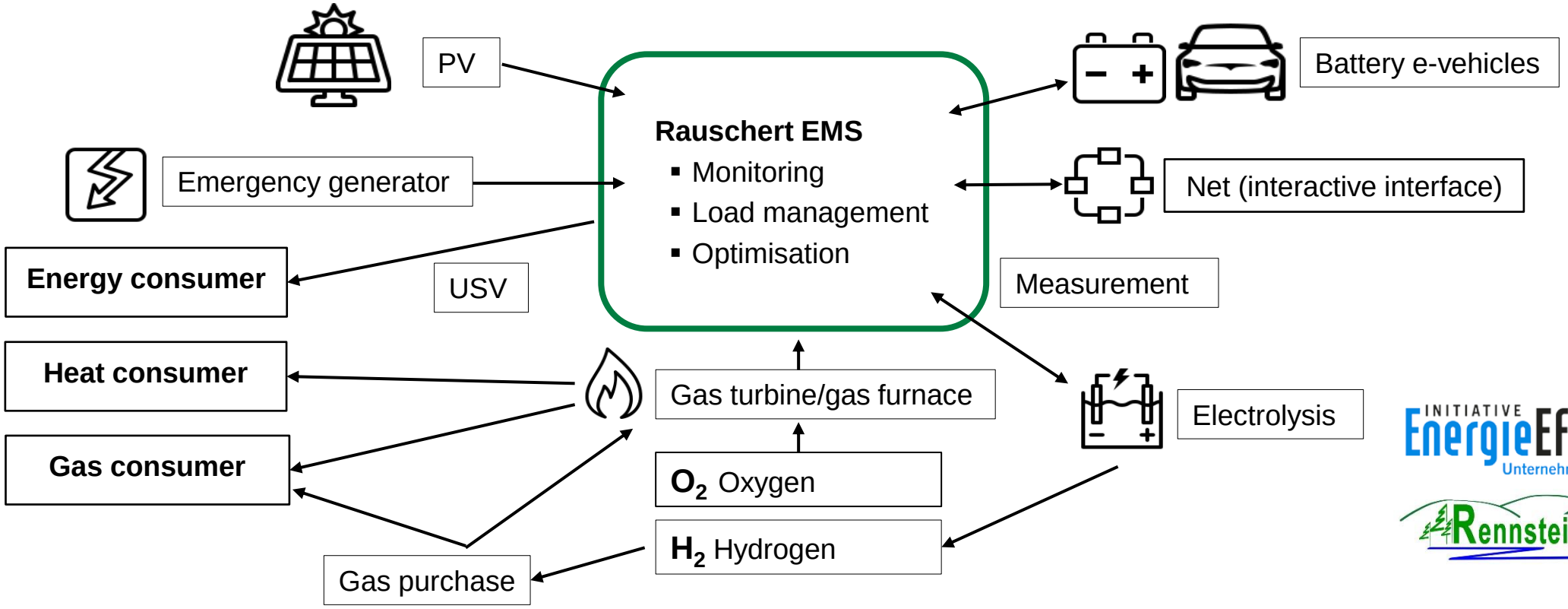
New carports

Flexible free-standing system with reflectors

Conventional open space

Energy at Rauschert is innovative and sustainable
Rauschert Energy Management System

- **Generating part of their own electricity is advantageous for industrial companies. Rauschert offers integrated solutions for this purpose and organises regional networks:**

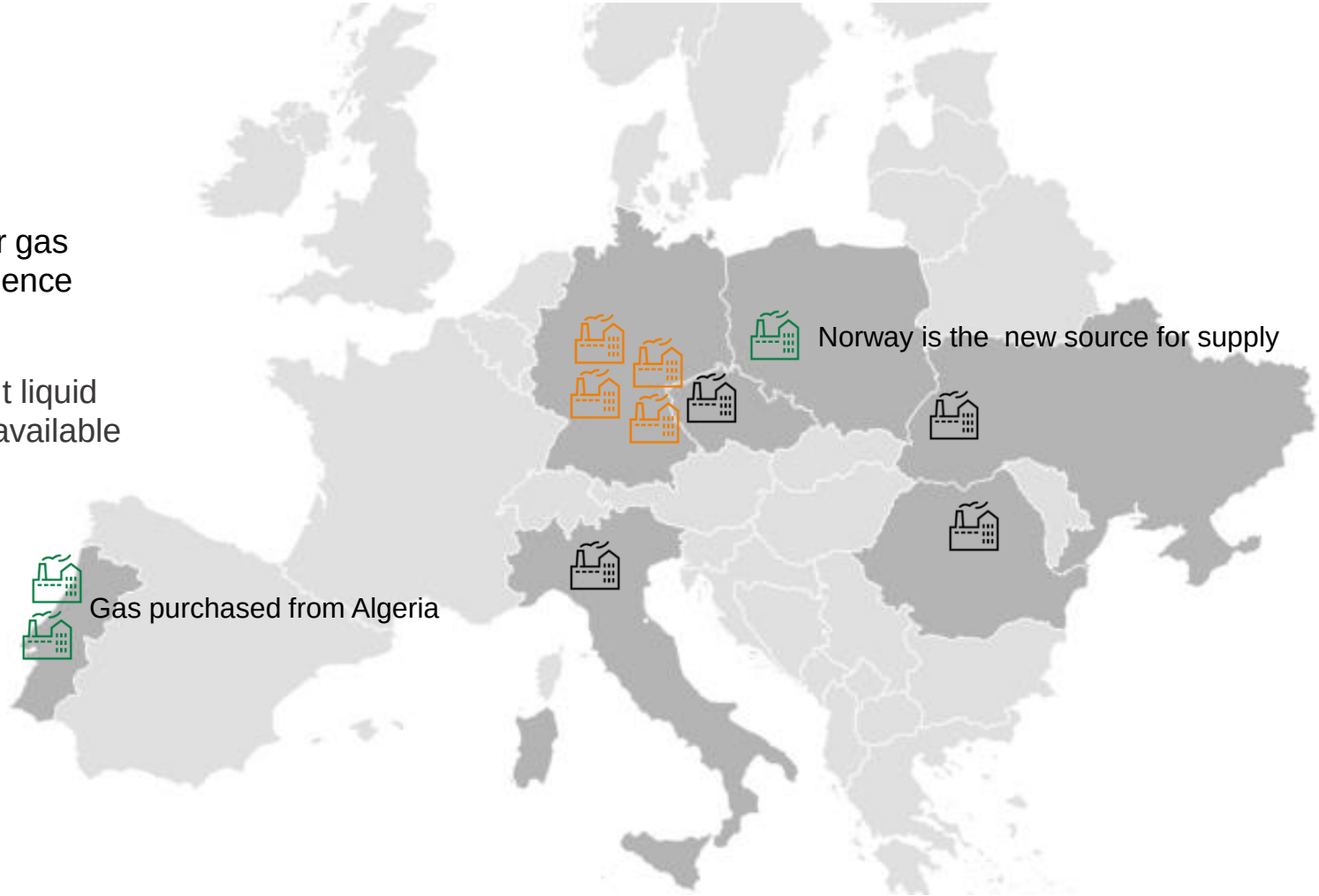


Supply of energy-intensive locations - The production network and multiple production lines provide safety

No gas supply from Russia

Industry highly prioritized for gas supply and reduced dependence on Russia

Risk of supply shortages, but liquid gas tanks and electric kilns available



Thanks for your attention!

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