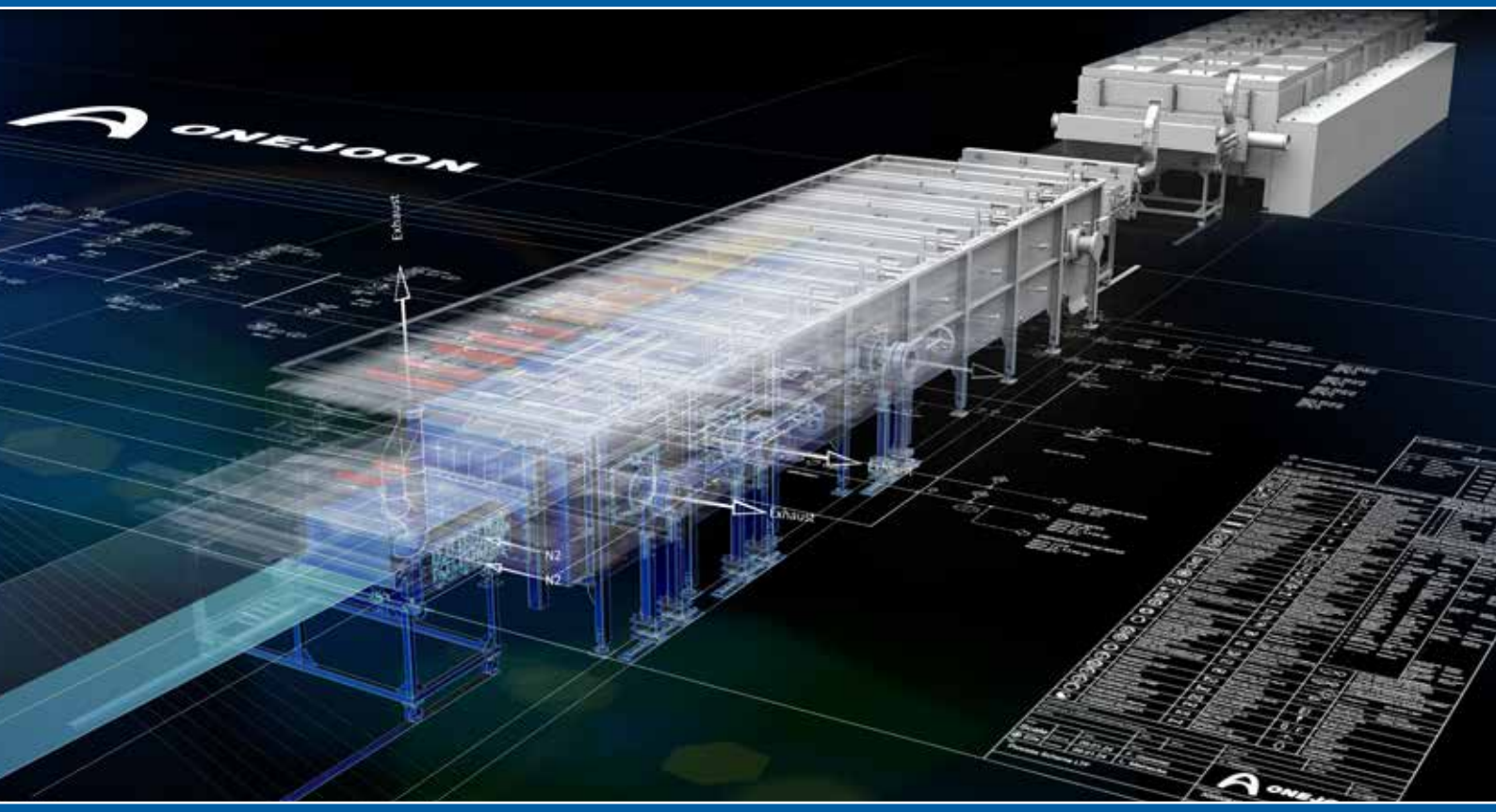
ONEJOON

CARBON FIBER & FELTS

PROCESSING LINES FOR THE PRODUCTION OF CARBON FIBER & FELTS



How **Carbon Fiber producers** can benefit from superior ONEJOON quality & best-in-class performance to embark on the road to net zero

MORE THAN 125 YEARS
EXPERIENCE IN KILN TECHNOLOGY
1896–2021

CARBON FIBER – MATERIAL THAT HAS AN IMPACT ON OUR FUTURE

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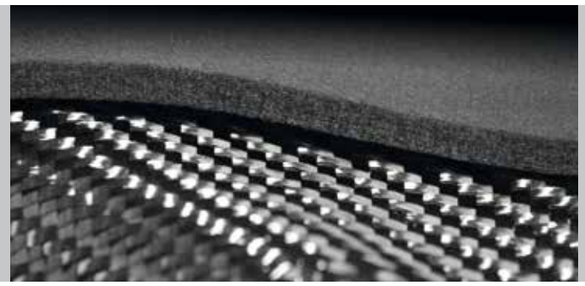


Carbon Fiber and Carbon Felt

WHY CARBON FIBER PRODUCTION LINES FROM ONEJOON?

We provide you with integrated solutions for Carbon Fiber production lines. Rely on proven, best-in-class equipment from the world's premier Carbon Fiber equipment provider.

Your benefits at a glance:

— Lower project costs through synergy effects in project planning, project management, installation and commissioning

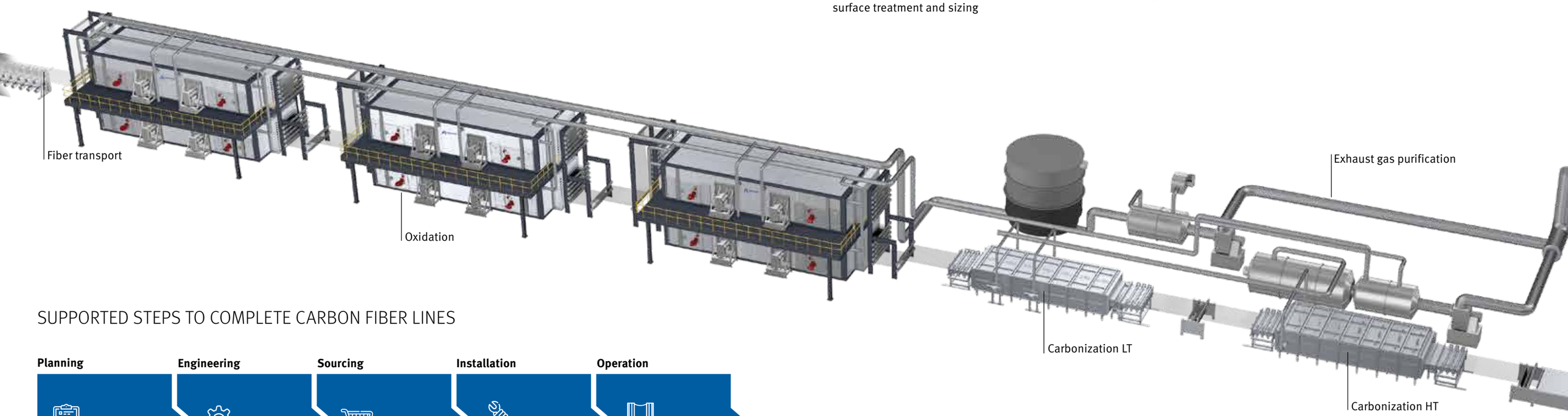
— High reliability and productivity through perfectly synchronized equipment and interfaces

— Reduced planning efforts

— User-friendly software integration for easy operation

— Fastest to the market and into production

— Lowest cost of ownership



SUPPORTED STEPS TO COMPLETE CARBON FIBER LINES

Planning
- Concept
- Feasibility study

Engineering
- Basic engineering
- Detail engineering
- Interface management
- HAZOP analysis

Sourcing
- Manufacturing
- Purchase

Installation
- Delivery
- Assembly
- Commissioning
- Training

Operation
- Start-up support
- Process improvement
- Maintenance/Services
- Spare parts

CARBON FIBER LINES – THE COMPLETE SOLUTION

Performance

- Well-balanced equipment ensures continuous operation and reduced downtime
- Best-in-class performance down to every single component

Sustainability

- Excellent energy efficiency in each production component
- Integrated energy recovery solutions
- Eco-friendly production methods

Reliability

- World class engineering ensures state-of-the-art equipment with proven quality and reliability
- Close network of partners for creels, winders, material handling, surface treatment and sizing

Service

- Always close to you through sales, engineering and service departments in Europe, North America, China and South Korea
- Extensive range of services, tailored individually to your needs
- 24 hours, 7 days on-call service for inspection, service, repair and spare part management

Extensive experience

- Global network and extensive experience with project management, planning, assembly and commission in system integration across many industries
- Over 125 years of total company history
- Test Center, R&D department
- Approx. 500 employees worldwide, more than 250 design engineers, researchers and developers

EMBARK ON THE ROAD TO NET ZERO – WITH ONEJOON

Carbon Fiber technology plays a major role in the energy transition. Products made from carbon fiber are put to use in various fields to reduce energy consumption, e.g. due to their lightweight, yet sturdy properties. They are also used to produce and store green energy. However, the process technology to obtain these products is in need of optimization to become more sustainable.

At ONEJOON, we continuously strive to improve our equipment to make it more energy-efficient and eco-friendly. One aspect is energy recovery, for example. We have an exciting journey ahead of us that calls for innovation. Let us embark on this journey together to make Carbon Fiber technology more sustainable.

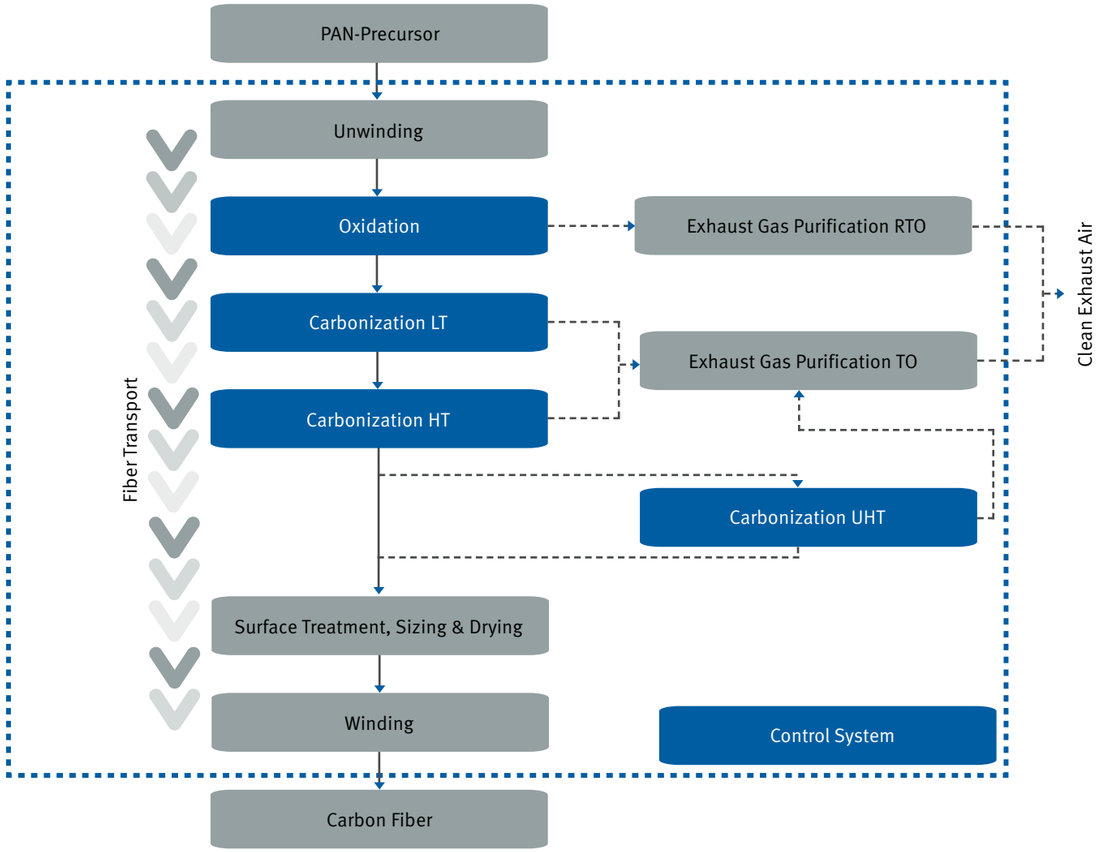
ONEJOON offers an excellent energy reduction strategy for the complete Carbon Fiber production line. This strategy includes reduced energy consumption in every single process step as well as integrated and customized energy recovery solutions, resulting in reduced operating costs and a smaller carbon footprint.

THESE MEASURES RESULT IN

REDUCED COSTS & SMALLER CARBON FOOTPRINT

PORTFOLIO

Complete based Carbon Fiber process



ONEJOON product range for Carbon Fiber lines

● Provided by ONEJOON ○ Provided by partners

Type	Oxidation Oven			Carbonization			Control system	Exhaust air purification		Winding unwinding	Fiber transport	Surface treatment, sizing & drying
	Center-to-End	Vertical-Down	End-to-End	LT	HT	UHT		RTO	TO			
Laboratory line		●	●	●	●	●	●		○	○	○	○
Pilot scale	●	●	●	●	●	●	●		○	○	○	○
Production scale	●	●	●	●	●	●	●	○	○	○	○	○

OXIDATION OVENS
Best-in-class airflow

Fiber quality

- Superior oxidized densities and fiber quality across the entire tow band by providing best-in class temperature and airflow uniformity over the entire process chamber
- Optimized fiber quality by matching the best airflow system for your precursor material

Design is key

- Patented supply nozzle air delivery channels for the End-to-End (E2E) and Center-to-End (CTE) technology
- Patented state-of-the-art end seal system
- Control system and software
- Thermo oil, electricity or natural gas as a heating source
- Natural gas heat exchangers with the highest thermal efficiency in the industry
- Optional hybrid heating with two heating sources
- Online airflow measurement
- Maintenance – free, seal welded interior

The airflow you need

- Depending on your preferences, ONEJOON offers different kinds of airflow systems:
- Vertical-Down – typically used for small tows
- End-to-End (E2E), Center-to-End (CTE) – used for small and heavy tows

End-to-End (E2E) oxidation oven

- Developed to meet the growing demand for industrial-grade Carbon Fiber production
- Utilization of widely accepted parallel airflow pattern used in Center-to-End ovens, but eliminating the central supply air plenum
- Supply air channels located on only one end of the chamber, directing air through the entire chamber
- Uniform airflow and temperature

Productivity

- Shortest oxidation times through best and safest control of the exothermal reaction
- Reduced maintenance time by providing complete access
- No downtime is required for the cleaning of filters during operation
- Removable supply and return nozzles provide easy access for cleaning
- Short heat-up time with hybrid heating technology

Efficiency

- Energy cost savings through minimized transmission losses and preheated fresh air for the end seal technology
- Lowest manufacturing costs per kg of Carbon Fiber
- Lowest expenses for energy using multiple heating sources
- Smallest footprint in the industry

Environmental protection

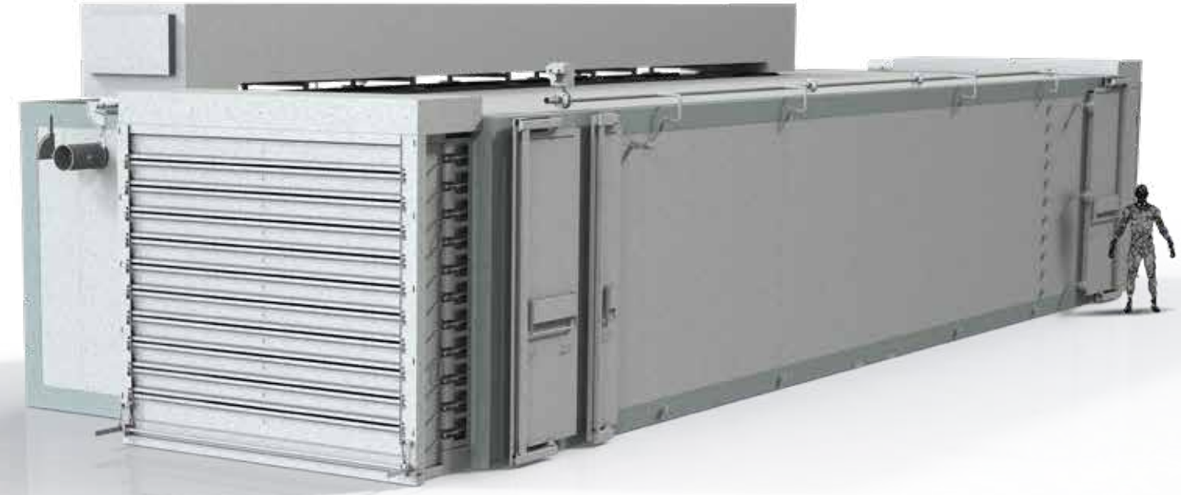
- Emphasis on operator safety through 100% prevention of process gas emissions by the patented multi-stage air sealing system and seal welded housing

Technical capabilities

- Comprehensive technical expertise from more than 125 years of experience in thermal processing technology
- Superior oxidation oven technology proven in pilot and large scale production facilities
- Preferred supplier for the oxidation process at established Carbon Fiber manufactures for high-end applications like aerospace

END-TO-END (E2E) BENEFITS

— Lower capital investment
— Lower operational energy costs
— Industries' lowest cost of ownership
— Incorporated hybrid heating system without adding to oven footprint
— Only one air circulation zone
— Reduced number of electrical and mechanical components
— Increased accessibility
— Less maintenance effort
— Less cleaning effort
— Improved up-time
— Greater range of catenary sags allowed



CARBONIZATION FURNACES FOR CARBON FIBER & FELT PRODUCTION

Best-in-class temperature uniformity

Fiber quality

- Superior carbonization quality across the entire tow band by providing best-in-class temperature uniformity inside the whole muffle

Low temperature furnace

- Carbonization temperatures up to 950 °C
- Natural gas or electric heating
- Patented muffle bearing system
- Steel muffle with the longest lifetime in the industry
- One-of-a-kind exhaust ports cleaning capabilities
- Gas distribution, measuring and control stations
- Control systems and software

High temperature furnace

- Carbonization temperatures up to 1,800 °C
- Electric heating
- Thoroughly designed graphite muffle
- Graphite heating cage with 75 % reduced lead-throughs
- Significantly reduced risk for oxygen infiltration
- Gas distribution, measuring and control stations
- Control systems and software

Ultra high temperature furnace

- Carbonization temperatures up to 3,000 °C
- Electric heating
- Gas distribution, measuring and control stations
- Control systems and software

Sealing boxes

- Insulated inlet sealing boxes with adjustable distortion free orifices
- Multifunction outlet sealing boxes with integrated cooling
- Gas preheating systems
- Cooling water distribution stations

Productivity

- Reduced downtime through the best-in-class durability of muffles and heaters
- Minimized condensation of tar at the inlet area of the muffle

Energy efficiency

- Low transmission losses
- Minimized consumption of protection gases

Carbonization furnaces for carbon felts

- Our carbonization furnaces are used for the production of gas diffusion layers (GDLs) that are key components in various types of fuel cells
- Also utilized for the production of soft and hard felt insulation materials for high-temperature applications

Reliability

- More than 125 years of experience in high-temperature technology up to 3,000 °C
- Specialist for heat-treatment plants with protective-gas and reactive gas atmospheres
- Preferred supplier for the carbonization process at established Carbon Fiber manufacturers for high-end applications like aero-space

SERVICE

Customer service is not a department. It’s an attitude.

Our operational service is centered around the principle of customer empowerment. We seek to provide your employees with the necessary knowledge and skills to successfully and confidently run the plant – with as little intervention from us as possible. That way, your qualified personnel is able to help themselves and purposefully communicate with the ONEJOON service via the hotline or remote support. A deep technical understanding on both sides leads to faster solutions and thus shorter downtimes.

Customer Empowerment

We provide you with the knowledge to help youself through operator trainings. This also includes FAQ, documentation and other useful tools.

Maintenance

To delay the progression of wear and tear or even fully prevent it, all necessary measures contributing to extended lifetime of the equipment are performed. They are also crucial for operational safety.

Inspection

Your equipment is put through its paces. Each component is precisely analyzed and compared to the target state.

Repair

To uphold the operating status, defective parts which are identified during inspection are repaired or exchanged.

Improvement / Retrofit

Changing circumstances and production targets might require adjusting your plant. We help you to meet the new criteria by modifying your equipment.

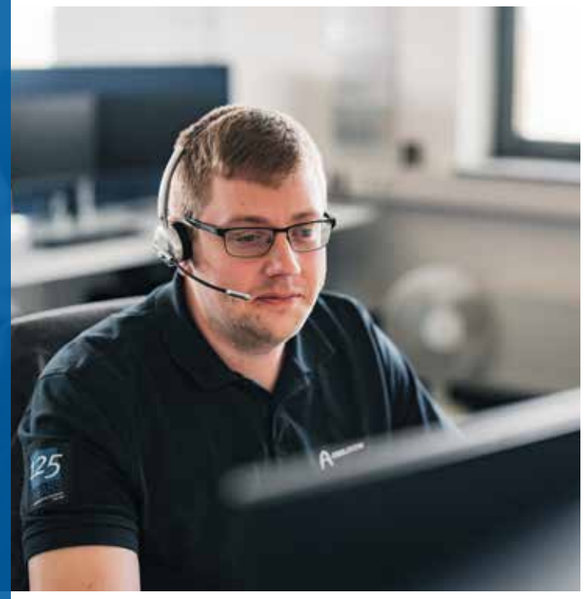
Support

To precisely locate problems and save time, we put our customer empowerment first. We help your employees to effectively communicate with our 24/7 hotline or VPN remote support.

MAINTAINING THE FUNCTIONALITY OF THE EQUIPMENT DURING THE LIFECYCLE

Our ONEJOON service is at your side – online, on site and worldwide. Besides empowering you to run your production line confidently, we offer you the following benefits:

— Ensuring operational safety
— Prevention of unnecessary & expensive downtimes
— Use of original spare parts
— Manufacturer competence
— Support by qualified personnel
— Warranty on work performed
— Planning assistance of costs & implementation
— On-site consultation



Oven performance validation and fiber oxidation trials

TEST CENTER

Scaling up heat treatment processes

Our German headquarters in Bovenden near Göttingen are home to a unique facility: the ONEJOON Test Center. Plenty of kiln types are at your disposal to develop and optimize your heat treatment process – up to 3,000 °C.

Not only do we provide the testing facilities for your process, we also have a structured program to guide you through each step from batch production or lab scale to fully-fledged continuous mass production. It is called **L2P (lab-to-production) program** and our ONEJOON experts are excited to help you scale up your heat treatment process. The program is **based on over 125 years of experience in industrial kiln construction** and our rich expertise obtained from numerous experiments for customers worldwide in our **Test Center**.

A UNIQUE FACILITY

In our ONEJOON Test Center, customers can develop, test & optimize their heat treatment processes with the help of our experts.

Major advantages of the L2P program:

- Benefit from our experts to guide you through each step of identifying and setting up the right equipment for your heat treatment process
- Fast and efficient upscaling of your process through a structured program
- Learn about and control every parameter **before** you invest in a plant (risk minimization at an early stage)
- Wide range of testing possibilities

ABOUT US

ONEJOON is your expert and partner for demanding heat treatment processes in a variety of industries

ONEJOON is a global industrial furnace manufacturer with over 125 years of experience and over 1,000 systems delivered to date. The company's furnace systems serve a temperature range from 100 to 3,000 °C and are used in the thermal treatment of numerous materials. These include the tempering of blade and saw bands, the sintering of metals and ceramics, or the production of cathode and anode material for lithium-ion batteries. In the area of systems for carbon fiber production, ONEJOON is the global market leader.

The company is not only a furnace supplier, but also supports customers in the area of process development. In two Test Centers, trials on heat treatment processes are carried out on behalf of customers. The ONEJOON L2P program ("lab to production") makes it possible to scale up these processes from the laboratory to industrial production.

ONEJOON headquarters in Suwon, South Korea

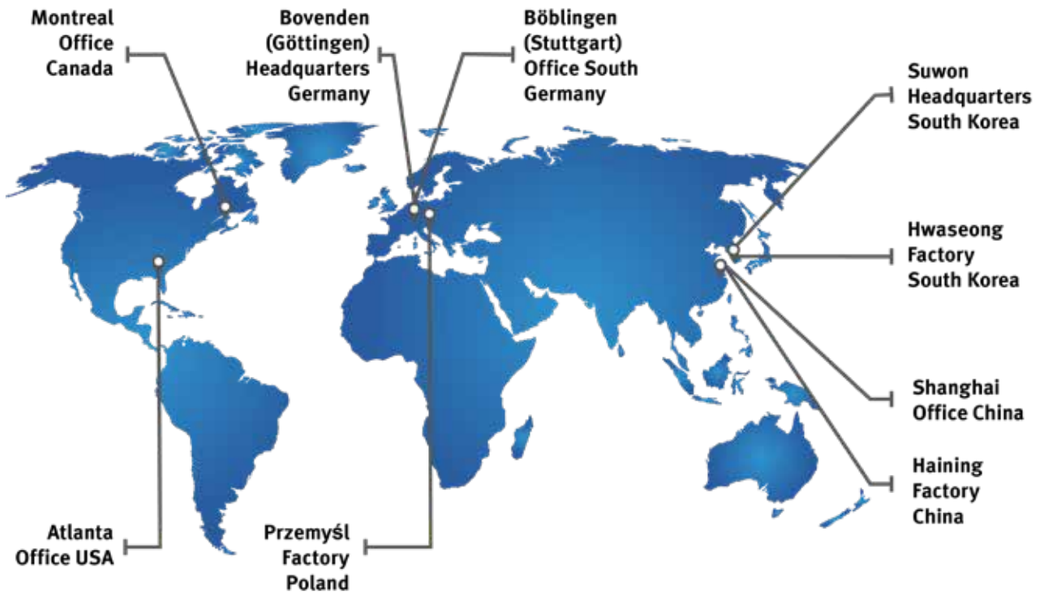
ONEJOON is represented at ten locations in six countries worldwide:

- Korea: headquarters in Suwon and production in Hwaseong (ONEJOON Ltd, Co.).
- Germany: Bovenden and Böblingen (ONEJOON GmbH, formerly Eisenmann Thermal Solutions GmbH & Co. KG)
- China: Shanghai and Haining (ONEJOON Zhejiang Co., Ltd.)
- USA: Atlanta (ONEJOON Inc.)
- Canada: Montreal (ONEJOON Thermal and Powder Process Solutions Inc.)
- Poland: Gliwice (ONEJOON Poland sp. z o.o.)

At ONEJOON, we see ourselves as a driving force of innovation. Nearly 500 employees work for the company, among them approx. 250 desgin engineers, developers and researchers. With the help of our kilns and furnaces, battery materials of the next generation are produced, through which the field of e-mobility is further advanced.

In addition, we serve as a development partner by scaling up thermal production processes, for example in the production of high-temperature electrolysis cells. In ONEJOON rotary kilns, complex pyrolysis processes can recycle and recover high-quality materials. As these applications show, we are doing our best to make kiln technology not only more efficient, but also more sustainable.

WE'RE RIGHT WHERE YOU NEED US.



CARBON FIBER EQUIPMENT BY ONEJOON

We are looking forward to your request!

LOWEST RISK SUPPLIER

LOWEST RISK SUPPLIER

SUPERIOR QUALITY

SUPERIOR QUALITY

BEST-IN-CLASS PERFORMANCE

BEST-IN-CLASS PERFORMANCE

COMPLETE THERMAL SOLUTIONS FROM A SINGLE SOURCE

COMPLETE

ENERGY SAVING

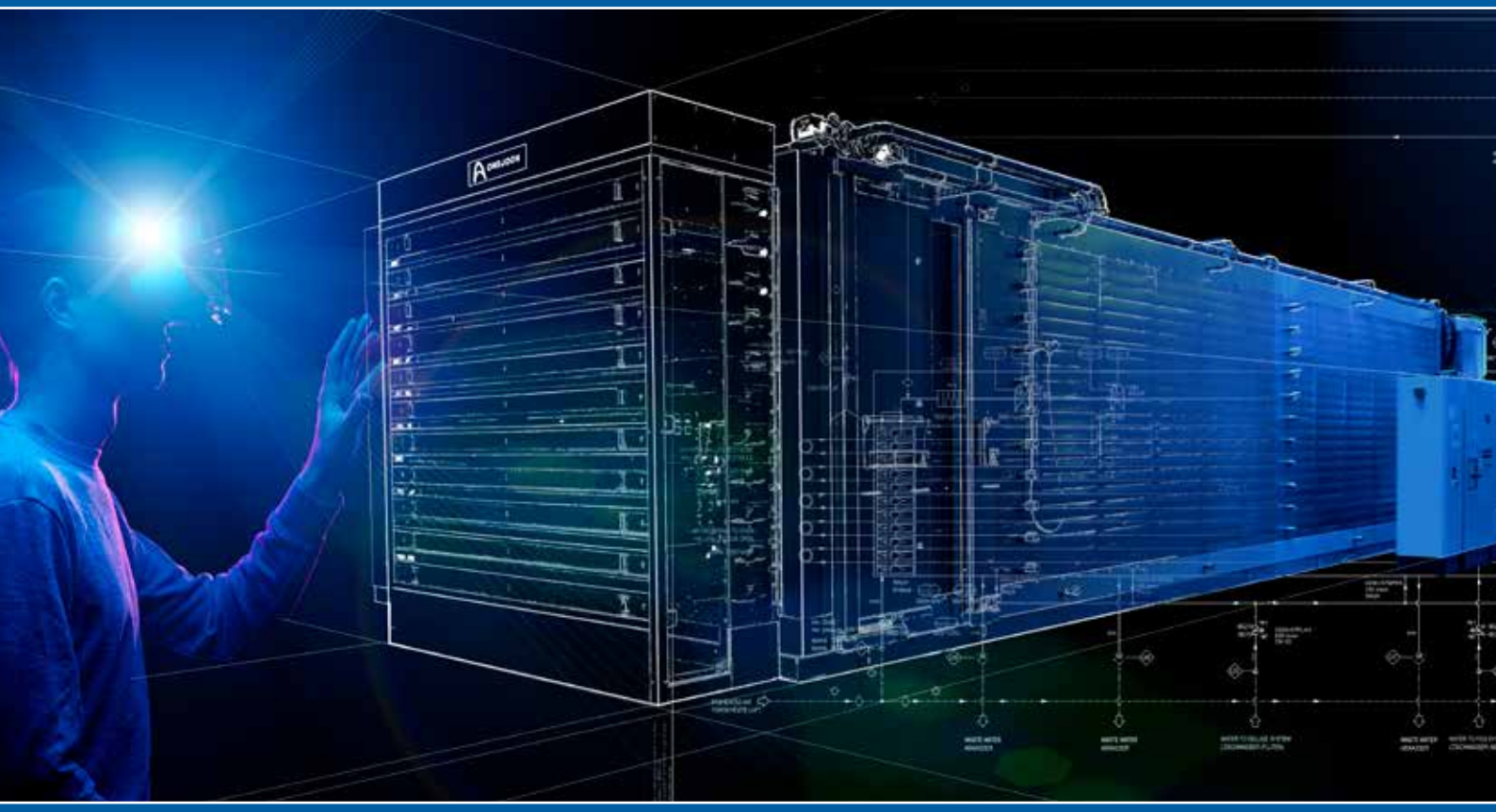
ENERGY SAVING CONCEPTS

FOR LOWEST COST OF OWNERSHIP

LEARN MORE ON OUR WEBSITE & GET IN TOUCH!

Contact us at **carbon.fiber@onejoon.de** or via our offices in Germany, the United States, Canada, South Korea & China

SCAN ME



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