



## OUR PRODUCTS

Consistent Implementation of Customer Needs

# OUR PRODUCTS

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# OUR VALUES

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| SERVICE & MAINTENANCE – Assisting you along the life cycle of your plant    | 10 |
| USEABILITY – For efficient and process-oriented operations                  | 9  |
| QUALITY – Our strength: a deep-seated quality consciousness                 | 8  |
| RESEARCH & DEVELOPMENT - Investment for the future                          | 7  |
| TECHNICAL CENTER – Comprehensive support even for the most complex of tasks | 6  |
| FCT SYSTEME GMBH - TODAY – From planning to realization                     | 5  |
| OUR STORY – Tradition for over 30 years                                     | 4  |

# Type HP W

Resistance heated, uniaxial hot press

| HP W<br>Standard types | Ø Heating conductor [mm] | Height heating conductor [mm] | Max. pressing force [kN] | Max. diameter of heading tool [mm] | Max. heating power [kW] |
|------------------------|--------------------------|-------------------------------|--------------------------|------------------------------------|-------------------------|
| HP W 5                 | 100                      | 125                           | 50                       | 30                                 | 17                      |
| HP W 25                | 200                      | 250                           | 250                      | 80                                 | 40                      |
| HP W 60                | 250                      | 315                           | 600                      | 120                                | 60                      |
| HP W 125               | 300                      | 400                           | 1250                     | 200                                | 100                     |
| HP W 250               | 440                      | 550                           | 2500                     | 300                                | 150                     |
| HP W 400               | 500                      | 800                           | 4000                     | 400                                | 180                     |
| HP W 600               | 600                      | 1200                          | 6000                     | 500                                | 240                     |
| HP W 900               | 750                      | 1200                          | 9000                     | 550                                | 400                     |

## Functions:

- Working temperature: up to 2200°C (option 1: temperatures of up to 2500°C; option 2: with O<sub>2</sub>/air atmosphere and temperatures of up to 1400°C)
- Vacuum:  $5 \times 10^{-2}$  mbar(a)
- Working gases: Ar/N<sub>2</sub> (further types of gases available upon request)
- Servo-hydraulic force control
- Precise, rigid portal frame with low deformation, accurate guiding of the heading tool
- Measuring device for compression stroke and compression speed
- Double-walled, water-cooled stainless steel vacuum chamber with a leakage rate of less than  $1 \times 10^{-3}$  mbar(a) l/s
- Easy accessibility
- Resistance heating (option: induction heating)
- Design and optimization of pressing tools/concepts
- Mould filling and emptying systems
- Optional rapid cooling systems
- Optional overpressure up to 1,0 MPa
- Optional debinding/dewaxing
- Handling systems, especially for large-sized furnaces
- Comprehensive and user-friendly process control Siemens S7 and WinCC
- Special sizes and functions available upon request
- Multi-zone heating



# Type HP D

Sintering furnace for FAST (SPS), directly heated

| HP D<br>Standard types | Component dimensions<br>[mm] | Max. pressing force<br>[kN] | Max. voltage<br>[V] | Max. current<br>[A] | Max. heating power<br>[kW] |
|------------------------|------------------------------|-----------------------------|---------------------|---------------------|----------------------------|
| HP D 1.25              | Ø 15                         | 12.5                        | 12                  | 3000                | 25                         |
| HP D 10                | Ø 50                         | 100                         | 7,2                 | 5500                | 37                         |
| HP D 25                | Ø 80                         | 250                         | 8                   | 8000                | 60                         |
| HP D 60                | Ø 120                        | 600                         | 8                   | 16000               | 120                        |
| HP D 125               | Ø 150                        | 1250                        | 8                   | 24000               | 180                        |
| HP D 250               | Ø 300                        | 2500                        | 8/16                | 48000/24000         | 360                        |

## Functions:

- Working temperature: up to 2400°C
- Vacuum:  $5 \times 10^{-2}$  mbar(a)
- Working gases: Ar/N<sub>2</sub> (further types of gases available upon request)
- Servo-hydraulic force control
- Precise, rigid portal frame with low deformation, accurate guiding of the heading tool
- Measuring device for compression stroke and compression speed
- Double-walled, water-cooled stainless steel vacuum chamber with a leakage rate of less than  $1 \times 10^{-3}$  mbar(a) l/s
- Easy accessibility
- Temperature measurement and control with either axial/radial pyrometer or flexible thermocouples
- Freely programmable sintering parameters with up to 45 segments per recipe
- Pulse on/off is freely programmable (1...255 ms) for each individual segment
- Heating rate: up to 1000 K/min (depending on tool size)
- Comprehensive software for data recording and evaluation of all sintering parameters

- User friendly online process management system available
- Semi-continued furnaces for industrial applications available



# Type H-HP D

Sintering furnace for FAST (SPS), hybrid heated

| H-HP D<br>Standard types | Component dimensions [mm] | Max. pressing force [kN] | Max. heating power FAST [kW] | Max. heating power Induction [kW] | Max. heating power Hybrid [kW] |
|--------------------------|---------------------------|--------------------------|------------------------------|-----------------------------------|--------------------------------|
| H-HP D 25                | Ø 100                     | 250                      | 60                           | 80                                | 100*                           |
| H-HP D 60                | Ø 150                     | 600                      | 120                          | 120                               | 200                            |
| H-HP D 250               | Ø 300                     | 2500                     | 300                          | 300                               | 500                            |
| H-HP D 400               | Ø 400                     | 4000                     | 400                          | 400                               | 700                            |

\* Option: flash sintering available

## Spark Plasma and Hybrid Sintering Furnaces

With this new sintering technique the tool and the component are directly heated by DC current pulses to reduce cycle times to a few minutes. The use of DC current pulses causes an additional increase in sintering activity in various materials due to the processes that occur at the points of contact of the powder particles (Joule heating, generation of plasma, electro migration etc.). Therefore, a significantly lower temperature as well as significantly lower mould pressure than is used for conventional hot pressing and sintering is needed.

Additionally, the furnaces can be equipped with a radial, inductive heating system in order to avoid radial temperature gradients with large-sized components or to heat up materials inductively that are otherwise inadequately conductive at room temperature.

Technology like this offers entirely new possibilities to manufacture numerous materials with extraordinary characteristics, e.g.:

- Sintered nanomaterial without significant grain growth
- FGM (“Functionally Graded Materials”)
- Composite materials
- Innovative carbide metals
- Aluminum and copper alloys as well as intermetallic compounds
- Structural and functional ceramics

H-HP D 250



# Type FH W

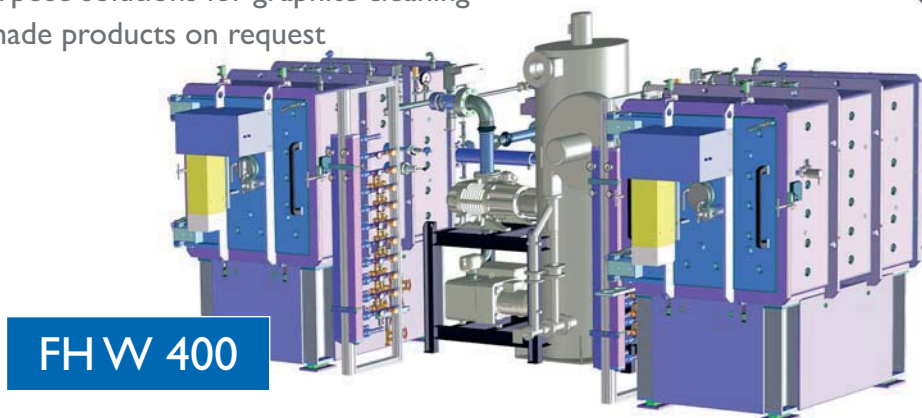
Resistance heated high-temperature vacuum sintering furnace,  
horizontally loaded

| FH W<br>Standard types | Width heating<br>conductor<br>[mm] | Height heating<br>conductor<br>[mm] | Length heating<br>conductor<br>[mm] | Usable volume<br>[dm <sup>3</sup> ] | Heating<br>power<br>[kW]*1 |
|------------------------|------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|----------------------------|
| FH W 9                 | 250                                | 250                                 | 300                                 | 9                                   | 20                         |
| FH W 90                | 500                                | 500                                 | 800                                 | 90                                  | 80                         |
| FH W 250               | 500                                | 710                                 | 1300                                | 250                                 | 200                        |
| FH W 400               | 950                                | 780                                 | 1000                                | 400                                 | 250*2                      |
| FH W 500               | 800                                | 900                                 | 1400                                | 500                                 | 270                        |
| FH W 1250              | 700                                | 1000                                | 2800                                | 1250                                | 300*2                      |
| FH W 2500              | 900                                | 1200                                | 2800                                | 2500                                | 450*2                      |

\*1 T = T= 2000°C with nitrogen (N<sub>2</sub>) atmosphere \*2 Option: available as twin system

## Functions:

- Working temperature: up to 2200°C  
(Option: up to 2500°C)
- Vacuum:  $5 \times 10^{-2}$  mbar (a)
- Leakage rate:  $5 \times 10^{-3}$  mbar(a) l/s
- Working gases: Ar/N<sub>2</sub> (further types of gases available upon request)
- Option: elongated heating zones up to 5000 mm
- Debinding and removal of temporary binders as option for combined processes
- Option: rapid cooling, insulation opening, gas circulation, heat exchanger
- Special sizes and functions available on request
- Special-purpose solutions for composite materials (e.g. C/C or C/SiC)
- Special-purpose solutions for graphite cleaning
- Custom-made products on request



# Type FS W

Resistance heated high-temperature vacuum sintering furnace,  
vertically loaded

| FS W<br>Standard types | Ø<br>Heating conductor<br>[mm] | Height<br>heating conductor<br>[mm] | Usable volume<br>[dm <sup>3</sup> ] | Heating power<br>[kW]* |
|------------------------|--------------------------------|-------------------------------------|-------------------------------------|------------------------|
| FS W 5                 | 200                            | 250                                 | 5                                   | 25                     |
| FS W 25                | 315                            | 400                                 | 25                                  | 60                     |
| FS W 80                | 400                            | 1000                                | 80                                  | 140                    |
| FS W 250               | 550                            | 1100                                | 250                                 | 140                    |
| FS W 500               | 750                            | 1600                                | 500                                 | 250                    |
| FS W 900               | 950                            | 1800                                | 900                                 | 350                    |

\*T = max. 2200°C with nitrogen (N<sub>2</sub>) atmosphere

Resistance heated high-temperature vacuum sintering furnaces come into operation in a wide range of applications, because they can be operated under vacuum as well as with inert atmospheres. Their main range of application is the debinding and subsequent sintering of ceramics and powder metallurgic components. Furthermore, this type of furnace is also used for high-temperature processes such as carbonization, recrystallization, silicon infiltration, nitriding (formation of Si<sub>3</sub>N<sub>4</sub>), vacuum sintering, metallization or heat treatment at high temperatures.

This furnace type is available with usable volumes between 9 dm<sup>3</sup> and 900 dm<sup>3</sup> and with maximum temperatures of up to 2500°C.



# Type FH I

Induction heated high-temperature vacuum sintering furnace,  
horizontally loaded

| <b>FH I</b><br>Standard types* | Susceptor<br>width<br>[mm] | Susceptor<br>height<br>[mm] | Susceptor<br>length<br>[mm] | Usable volume<br>[dm <sup>3</sup> ] | Heating<br>power<br>[kW] |
|--------------------------------|----------------------------|-----------------------------|-----------------------------|-------------------------------------|--------------------------|
| FH I 1250                      | 600                        | 1000                        | 2800                        | 1250                                | 400                      |
| FH I 2500                      | 870                        | 850                         | 4000                        | 2500                                | 600                      |
| FH I 4000                      | 870                        | 1200                        | 4500                        | 4000                                | 800                      |

\* Specific customizations on request

## Functions:

- Working temperature: up to 2500°C  
(Option: up to 2800°C)
- Vacuum:  $5 \times 10^{-2}$  mbar(a)
- Working gases: Ar/N<sub>2</sub> (further types of gases  
available upon request)
- Option: elongated heating zones up to 8000 mm
- Debinding and removal of temporary binders as  
option for combined processes
- Option: rapid cooling, insulation opening,  
gas circulation
- Special sizes and functions available on request
- Special-purpose solutions for composite  
materials (e.g. C/C or C/SiC)
- Special-purpose solutions for graphite cleaning

Due to their induction heating, induction-heated high temperature furnaces are particularly used when large furnace volumes and working temperatures of up to 2500°C are needed.

The constant release of energy of the induction-heated graphite susceptor enables the achievement of excellent uniformity of temperature even at temperatures of more than 2500°C.

The higher investment costs for such furnaces in comparison to resistance-heated furnaces are compensated by a longer life cycle of this furnace type. In particular cases, these technically sophisticated furnaces can be conceptualized and optimized in close collaboration with the end-user and can also be adjusted to individual tasks.

## FH I 2500





# Type FS I

Induction heated high-temperature vacuum sintering furnace,  
vertically loaded

| FS I<br>Standard types* | Susceptor<br>dimensions<br>[mm] | Usable volume<br>[dm <sup>3</sup> ] | Heating power<br>[kW] |
|-------------------------|---------------------------------|-------------------------------------|-----------------------|
| FS I 750                | Ø 920 x 1400                    | 750                                 | 500                   |
| FS I 1200               | 850 x 850 x 2400                | 1200                                | 900                   |

\* Specific customizations on request



# Type FP W

High-temperature gas pressure sintering furnace (Sinter-HIP),  
resistance heated, 10 MPa

| FP W<br>Standard types | Ø<br>Heating conductor<br>[mm] | Height<br>Heating conductor<br>[mm] | Usable volume<br>[dm <sup>3</sup> ] | Heating power<br>[kW] |
|------------------------|--------------------------------|-------------------------------------|-------------------------------------|-----------------------|
| FP W 1.25              | 125                            | 180                                 | 1.25                                | 25                    |
| FP W 6                 | 180                            | 300                                 | 6                                   | 60                    |
| FP W 12.5              | 250                            | 315                                 | 12.5                                | 80                    |
| FP W 25                | 280                            | 550                                 | 25                                  | 120                   |
| FP W 90                | 400                            | 900                                 | 90                                  | 160                   |
| FP W 250               | 600                            | 1600                                | 250                                 | 250                   |
| FP W 600               | 700                            | 1800                                | 600                                 | 350                   |
| FP W 900               | 860                            | 2000                                | 900                                 | 500                   |

## Functions:

- Working temperature: up to 2000°C  
(Option: up to 2400°C)
- Vacuum: up to  $5 \times 10^{-2}$  mbar(a)
- Working pressure: up to 100 bar(g) (10 MPa)  
(Option: up to 20 MPa)
- Debinding/dewaxing - sintering - gas pressure sintering in a combined process (Sinter-HIP)
- Rapid cooling (overpressure)
- Design: vertically loaded from the bottom
- Special sizes and functions available upon request
- Loading and handling systems available upon request
- Process control with superordinated visualization system
- Temperature measurement and control via optional pyrometer and/or optional thermocouple
- Adjustable gas mixing
- Special MIM/CIM-furnaces (MIM = Metal Injection Moulding / CIM = Ceramic Injection Moulding)
- Optional dilatometer



# SPECIAL PURPOSE MACHINERY

Made-to-order high-temperature sintering plants and complete manufacturing concepts



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In addition to numerous system solutions based on a standardized delivery program for sintering units, FCT Systeme GmbH today also offers specific customized solutions for extraordinary applications:

- CVD/CVI coating systems
- Squeeze casting (gas pressure infiltration)
- Diffusion welding using FAST/SPS technology
- High-vacuum furnaces with metal heaters
- Thermal post-combustion for combined processes
- Debinding units
- Flare systems for operations with H<sub>2</sub>
- Special filtering systems
- Specific gas vacuum systems for partial pressure regulation and client-specific tasks
- Optional gas analysis

Additional components on our furnaces enable the accomplishment of special tasks and provide our customers with complete, efficient and process oriented solutions:

The better part of special purpose machinery developed by FCT Systeme GmbH in the past represents state-of-the-art technology today.