

The Solution



## Vacuum-Plants VKPgr

Dewaxing, Sintering and  
Overpressure Sintering

# Vacuum-Plants VKPgr

## Applications

The sinter-hip furnace VKPgr will be used for dewaxing, vacuum sintering and overpressure sintering up to a rated temperature of 1600°C and a rated pressure up to 6 (10) MPa. Its unique heating principle ensures an excellent temperature uniformity. Beside the sintering of cemented carbides also other suitable PM materials can be processed in this furnace.

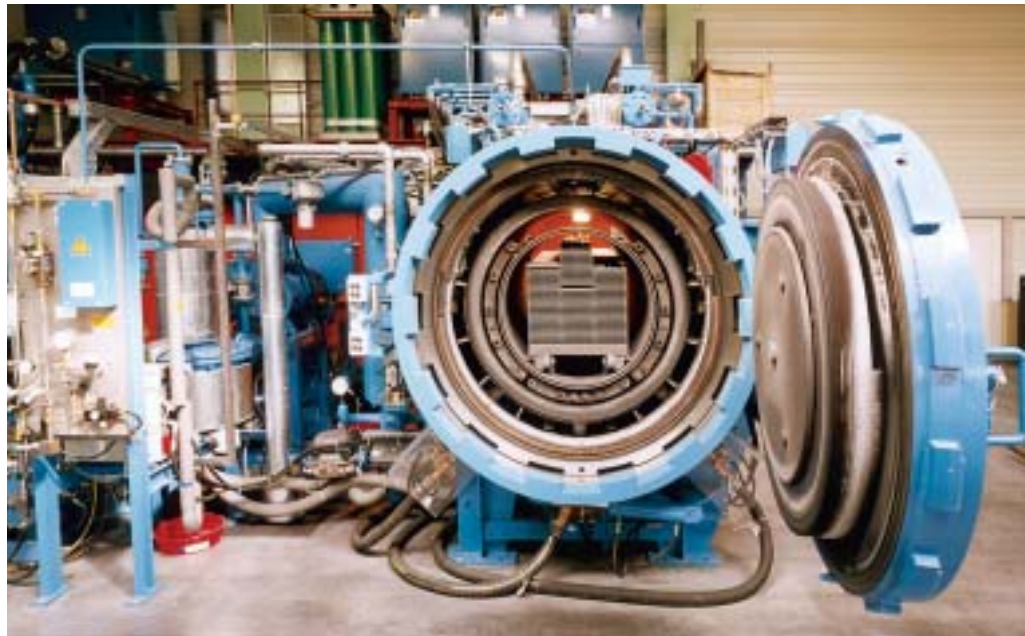
## General

- The VKPgr furnace is build up from modularized sub-units with simple and well accessible equipment components
- Sub-units for the VKPgr will be pretested at ALD's sub-suppliers, which are tied on to ALD's quality system.
- Standardized VKPgr furnaces will be completely assembled before shipment, functional tested (cold function test), hot test on request
- Fast re-assembly and start-up of the plant at customers site because of its previous pre-assembly and testing

## Furnace design

### Multidewaxingsystem

- Well established, high flexible multidewaxing system ensures up to 4 different dewaxing processes (option):
  - Argon-low-pressure dewaxing for paraffin ( $\Delta p$ )
  - H<sub>2</sub> – overpressure dewaxing for paraffin with burnoff
  - H<sub>2</sub> – overpressure dewaxing for PEG with burnoff
  - H<sub>2</sub> – low pressure dewaxing for paraffin
- Automated temperature control of condenser via process progress, ALD-patent EP 1046448 A2
- Ramp evacuation function (to prevent too fast vapouration of pressing aids)



Vacuum sintering furnace VKPgr 50/50/170.

### Application of process gases

- Sinter-hip needs high pressure argon gas
- Sintering with process gases such as: Ar, H<sub>2</sub>, N<sub>2</sub>, CH<sub>4</sub>, CO, and others by means of massflow controllers
- Sinter gases feed directly into the muffle and onto the workpieces
- Pressure control in the working space during sintering and dewaxing (lower pressures in the muffle attainable)
- Symmetrical guiding of the gas in the furnace during dewaxing and process gas treatment
- Ar-partial pressure control prevents cobalt vapouration
- Safety equipment for the use of flammable process gases

### Vacuum pump set

- Vacuum pump sets sufficiently sized to the volume of the plants suited for the applied process consisting of one van pump and one roots blower make LH or Pfeiffer Vacuum, other types on request

### Fast cooling unit

- 2-efficient rapid cooling systems, can be combined, installed in every standard basic plant, which remarkably reduce the cycle time at minimum wear of installed graphite parts:
  - Large gas/water heat exchanger on the inside of the pressure vessel
  - System for Ar-gas refilling during cooling phase
  - Additional rapid cooling systems available on request

## History

For more than 50 years ALD (formerly Degussa) manufactures sintering furnaces for cemented carbides, cermets and other PM materials. ALD is a company, certified according to DIN / ISO 9001 and VDA 6.4 and worldwide leader in equipment and services of vacuum process technology. ALD customers participate on the long term experience and know how of more than 89 delivered VKPgr furnaces.

### Pressure vessel

- Double-walled, water-cooled, horizontal, cylindrical pressure vessel, designed for a high number of load cycles/lifetime, for rated pressures of 6 (10) MPa
- Two doors, each with one 3-piece quick acting bayonet lock, hydraulically operated
- Hydraulically operated blocking slides for both lock rings, electrically monitored
- Current lead throughs for external disassembly (without disassembly of the muffle and insulation cylinder)
- Inspection of the construction and first pressure testing for the pressure vessel according to DGRL / TÜV, other pressure vessel code requirements on request

### Heating insert

- Resistant heated furnace with 3 (4) independently controlled heating circuits in the 6 (10) MPa furnace version
- Round muffle and heating insert in a round pressure vessel guarantees a flexible and high density of the load
- Bottom heating separately controlled (for example for dewaxing of large parts)
- High temperature uniformity through the symmetrical arrangement of the heating circuits (longitudinal and cross axis)

- Hydraulically operated graphite muffle and insulation doors, sealed by a spring system, also ensures sealing during thermal expansion/shrinkage, low in maintenance
- Long-life special hard felt insulation cylinder, low in maintenance because of plane insulation surfaces
- Simple loading of the furnace by means of a graphite roller track in the furnace
- Very simple, time-saving assembly and maintenance for heating insert, many identical parts, minimum requirement of spare parts
- Earth fault detectors for all heating circuits prevent "arcing"
- Automatic recognition of wear on the graphite heaters, option, ALD-Patent EP 01101496

### Electrical equipment

- Power package consisting of communicating single-phase thyristor power controller, high current transformer and watercooled high current cables for each heating circuit
- PLC control (Siemens S7) with PC, TFT-monitor and color printer as an operator and visualization unit
- Recipe and batch log management by means of PC

- Batch and equipment data storage on PC, exportable to Excel
- Additional user panel Siemens OP 17 for manual control in emergency case without PC
- Online visualization of the S7 interlocking level in clear text on the PC monitor
- Modem for PC / PLC for diagnostics via telecom system for maintenance and failure
- Redundant interlocking system (PLC and relays) for all door functions and options for flammable gases
- Adjustable, multi-lingual PC- interface, (German, English, Russian, Chinese and other languages)
- Earth fault detectors of all heating circuits
- Thermo-electric flow guards for water with analogue mass-flow indication

### Auxiliary equipment and additional services

- Charge car for loading of VKPgr
- Closed cooling water recooling plant
- Argon gas supply and recycling systems
- Uninterruptable power supply
- Assembly supervision, start-up, training for customer's personnel
- Graphite charging plates
- Spare parts, consumables, services



Full hard-metal drills with straight and helical twisted coolant holes.



Hard metal tools for mining and road construction.



Hard metal micro-drills and micro-cutters for printed circuit boards.

## Technical Data

### VKpgr 60 bar / 100 bar

#### Standard Vacuum Furnaces for Dewaxing, Sintering and Overpressure Sintering

Size, horizontal*		30/30/90	50/50/90	50/50/150	50/50/170	50/50/230	50/50/270
Working space with assured temperature uniformity							
Width	mm	300	500	500	500	500	500
Height	mm	300	500	500	500	500	500
Length	mm	900	900	1500	1700	2300	2700
Useful volume litre	dm <sup>3</sup>	81	225	375	425	575	675
Clear muffle space dimensions, possible usable volume							
Diameter x Length	mm	500 x 1165	800 x 1165	800 x 1765	800 x 1965	800 x 2605	800 x 3005
Useful volume litre	dm <sup>3</sup>	229	585	887	987	1309	1510
Useful volume without muffle litre <sup>1)</sup>	dm <sup>3</sup>	277	661	1001	1115	1477	1705
Max. charge weight, gross <sup>2)</sup>	kg	300	800	1100	1300	1700	1900
heating zones: 60 bar/100 bar		3 / 4	3 / 4	3 / 4	3 / 4	3 / 4	3 / 4
Rated temperature	°C	1600	1600	1600	1600	1600	1600
Operating temperature max.	°C	1580	1580	1580	1580	1580	1580
Temperature uniformity							
During vacuum above 1000 °C		± 7 K	± 7 K	± 7 K	± 7 K	± 7 K	± 7 K
During overpressure sintering operation, 5.0 MPa, 1400°C		± 10 K	± 10 K	± 10 K	± 10 K	± 10 K	± 10 K
Nominal pressure, Ar, 60/100 bar	MPa	6 / 10	6 / 10	6 / 10	6 / 10	6 / 10	6 / 10
Working pressure max. (Ar)	MPa	5.8 / 9.8	5.8 / 9.8	5.8 / 9.8	5.8 / 9.8	5.8 / 9.8	5.8 / 9.8
Ultimate vacuum in clean, dry empty and cold furnace							
	hPa	5 x 10 <sup>-2</sup>	5 x 10 <sup>-2</sup>	5 x 10 <sup>-2</sup>	5 x 10 <sup>-2</sup>	5 x 10 <sup>-2</sup>	5 x 10 <sup>-2</sup>
Rated voltage, 3 ph AC, 50 Hz		3 x 400	3 x 400	3 x 400	3 x 400	3 x 400	3 x 400
Rated power connection <sup>3)</sup>							
60/100 bar	kVA	375 / 375	520 / 600	520 / 600	520 / 600	600 / 660	600 / 700
Steady state power app.							
60/100 bar	kW	80 / 100	160 / 185	160 / 185	190 / 225	200 / 235	200 / 270
Gas consumption, at 1400°C, 5.5 MPa / 9.5 MPa, app.							
60/100 bar	Nm <sup>3</sup>	25 / 43	43 / 74	55 / 95	65 / 112	100 / 173	130 / 225
Cooling water consumption, at 1400°C							
5 MPa/9 MPa, app. 60/100 bar	m <sup>3</sup> /h	13 / 17	18 / 22	24 / 28	25 / 29	31 / 35	35 / 39
Emergency water supply							
60/100 bar	m <sup>3</sup> /h	4 / 6	6 / 8	8 / 10	8 / 10	12 / 14	14 / 16
Space requirements							
(w x l x h) approx.	m	7 x 5 x 3	9 x 7 x 3	9 x 7 x 3	9 x 7 x 3	10 x 7 x 3	11 x 7 x 3

1) Without dewaxing the muffle can be eliminated, therefore larger useful volume

2) Higher charge weights on request

3) Lower rated power units on request

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