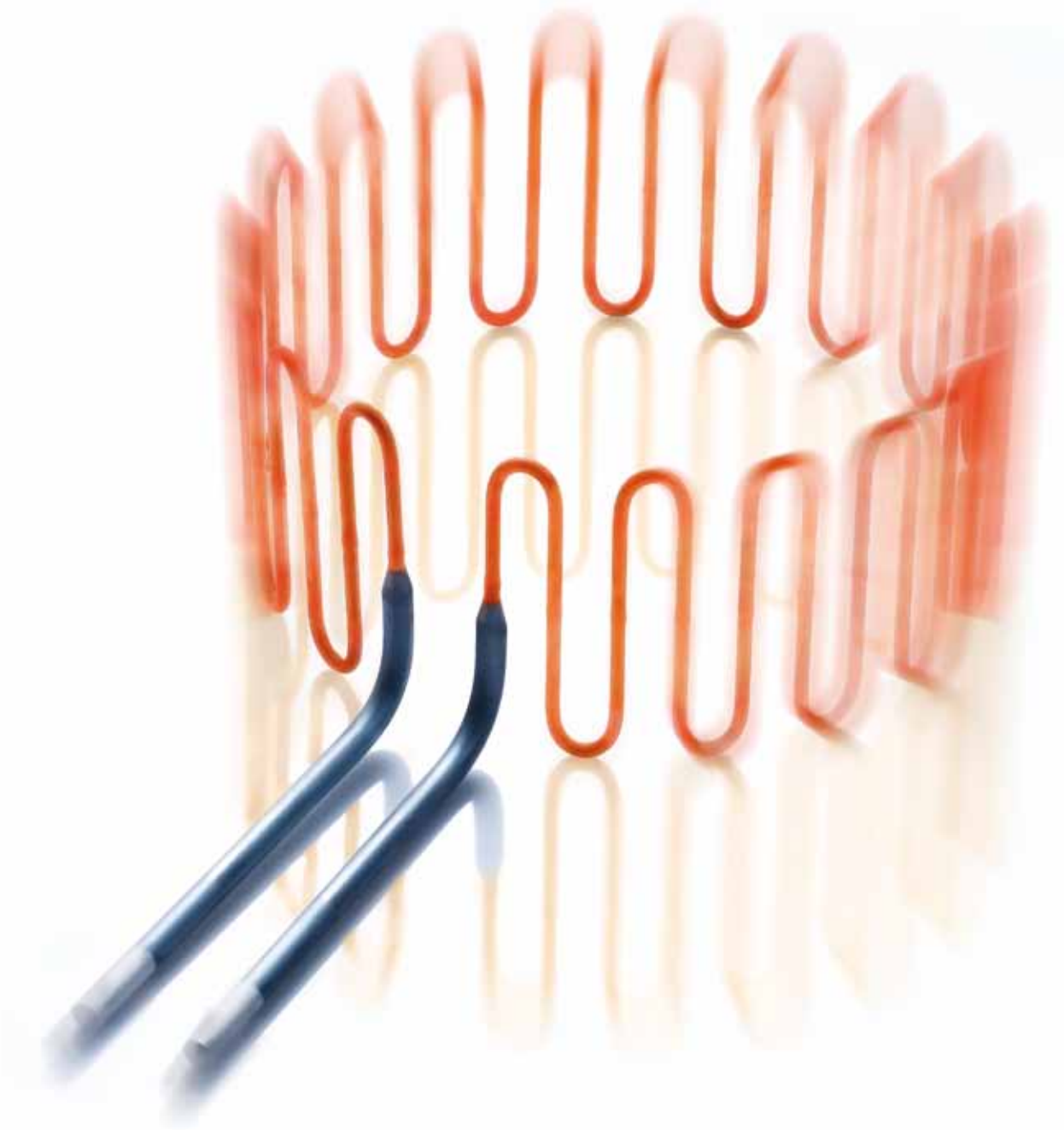


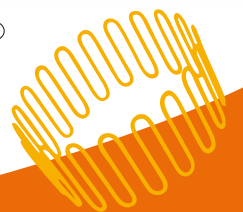
The Power of Partnership

HIGH TEMPERATURE TECHNOLOGY

660°C - 1,850°C



GERMANY **M.E.SCHUPP**[®]
HIGH TEMPERATURE TECHNOLOGY
WWW.SCHUPP-CERAMICS.COM



UNBEATABLE VALUE FOR MONEY - no Compromising on Quality

The products and components of M.E.SCHUPP® are produced for the construction and operation of high-temperature furnace & kiln systems for sintering, firing, melting and heat treating processes within a core temperature range of 1,250°C to 1,850°C. PTCR ring gauges: 660°C to 1,750°C.

M.E.SCHUPP®-PRODUCTS

- offer you a price advantage in the double-digit percent range compared to other top quality providers
- provide outstanding "engineered and made in Germany" quality
- include standard products and customized products to suit your specific high-temperature application
- are delivered to you first-class, securely and in very short time
- work in high temperature systems
 - Electric heating (MoSi₂),
 - Thermal insulation (PCW),
 - Process temperature control (by ceramics),
 - Elemental analysis (by ceramics).

Our target is to answer to your inquiries within 24 hours. Additionally, you will benefit from efficient international logistical services from our professional partners.

M.E.SCHUPP® is a family-owned company, based in Aachen since 1996. Our committed and experienced workforce now numbering 36 employees have the enthusiasm and commitment, to advise you and work with you to find the optimum system solution configuration to meet your specific high-temperature technology needs. Modern industrial companies with the courage and desire to further development are in good hands with us: we provide personal and direct service, technical competence, commercially optimized solutions, and logistical reliability.

We act internationally, and yet conceptually we are typically German: providing quality, reliability, punctuality.

Your success is what drives us, our passion is technology, being your supplier a privilege!

And I vouch for that with my name.

Michael E. Schupp
Company owner and managing director, 2011

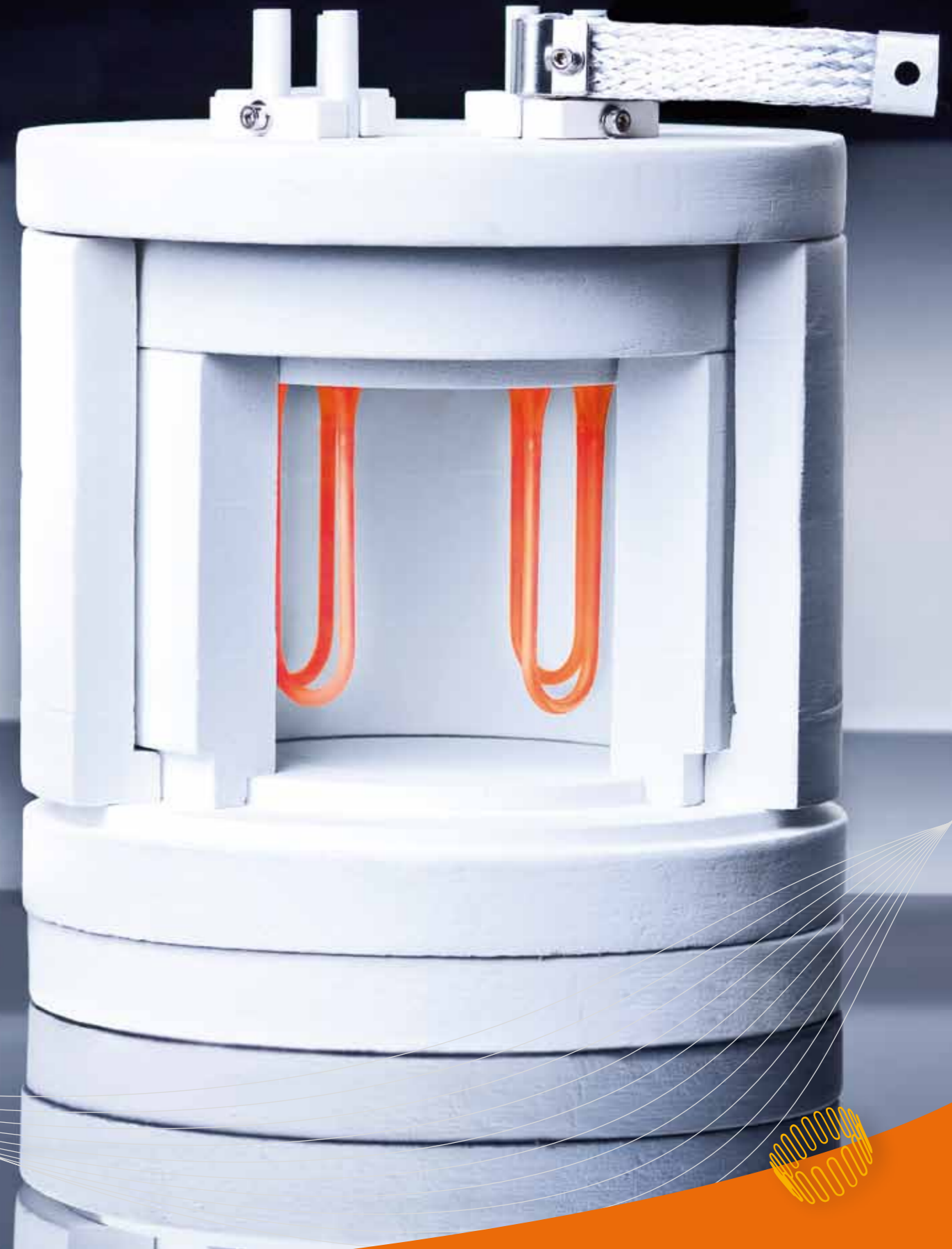
M.E.SCHUPP® FACTS

| | |
|-------------------|--|
| Foundation: | 1996 |
| Employees: | 36 (2011) |
| Turnover: | 7 million € (2011) |
| Clients: | 900 (worldwide) |
| Equity Capital: | > 30 % |
| Export: | 65 % |
| Location: | Aachen, in the triangle D/B/NL |
| Company premises: | 2,500 m ² Production 1,200 m ² High Rack Warehouse 1,000 m ² Office 300 m ² |



"I am personally touched by what we have achieved for our customers during the recent years and we now fill the phrase of technology and innovation with substantial content for these customers."

Benefit from the very competitive prices a family-owned company with an efficient professional organization, team structure and its own production plants can offer. Many components and systems, whether standard or customized, can be produced for you in an economically effective manner here in Aachen. Our flexible organization, own inhouse production and first class external production partner combine to provide you with price benefits in the double-digit percent range. Convince yourself of the cost benefits to be had and ask us for a quote.



HEATING
INSULATION
MEASURING



QUALITY - certified, comprehensive,
engineered & made in Germany

The M.E.SCHUPP® quality management system ensures your high-temperature components and technical solutions “engineered and made in Germany”, are produced and monitored in accordance with ISO 9001:2000 guidelines.

From the receipt of the raw material on our premises through to the delivery of the end product to you, your required components are produced in a structured, transparent and controlled production flow, in Aachen and at our external production partners. Your success is what drives us!



M.E.SCHUPP MOLYCOM[®]-ULTRA 1,700 1,800 & 1,900

Electric heating elements (MoSi₂) up to 1,900°C



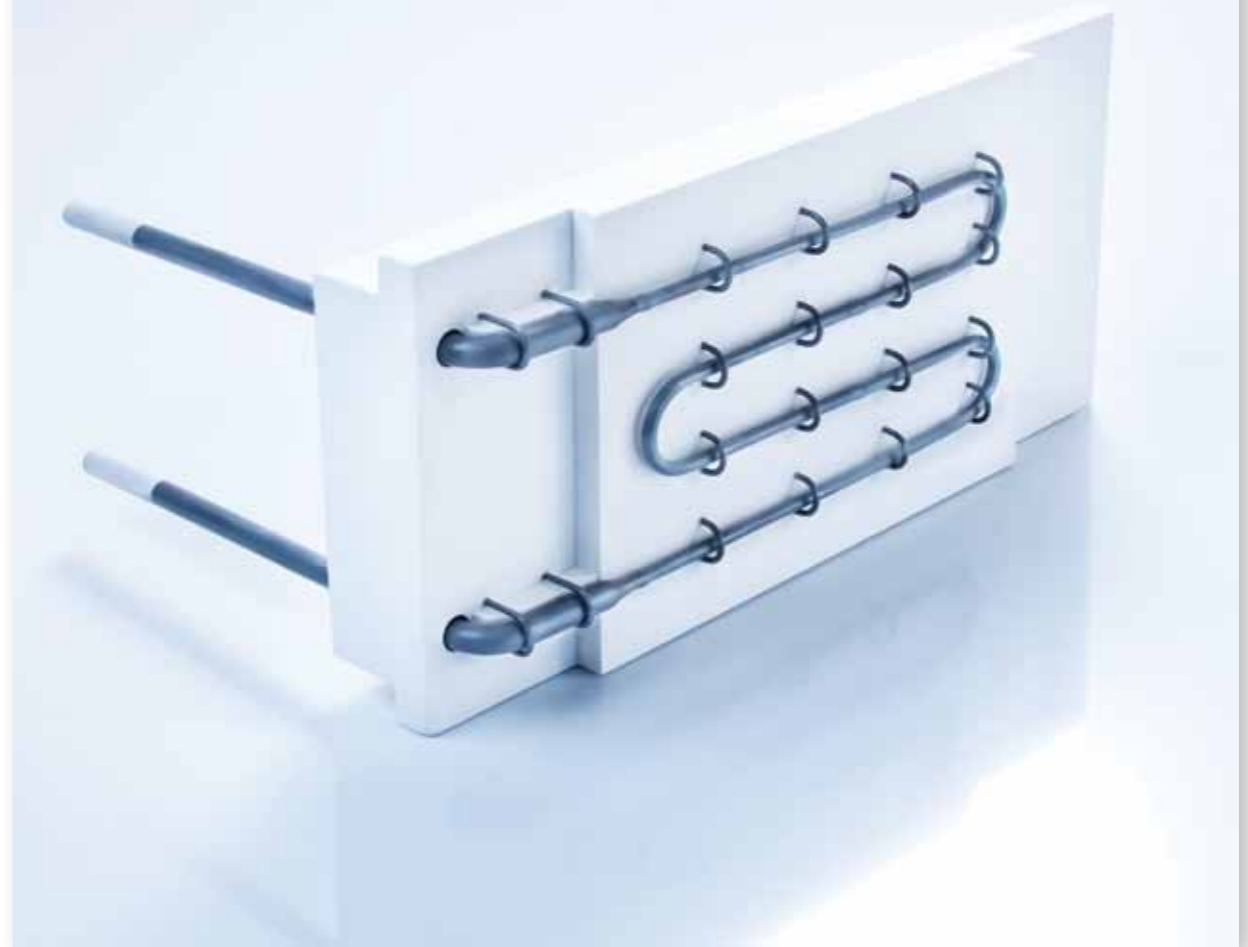
- M.E.SCHUPP[®]-industrial standard: MolyCom[®]-Ultra
- Productive and state-of-the-art technology, engineered & made in Germany
- High Purity: MolyCom[®]-Hyper
- High power electrical output ($\geq 25 \text{ W/cm}^2$)
- Complex heating element geometries are possible
- Standard dimensions: 3/6 mm, 4/9 mm, 6/12 mm, 9/18 mm, 12/24 mm, U, L, W shaped and bent elements
- Standard lengths from 100 mm to > 2,000 mm and other customized production on request
- All accessory parts such as holders, connecting bands and other customized parts can be supplied
- Fully compatible to elements of comparable manufactures

M.E.SCHUPP MOLYCOM[®]-HYPER 1,800



M.E.SCHUPP MOLYTEC[®] 1,650

Electric heating panels and cylinders
(MoSi₂ + PCW) up to 1,650°C



- Electric heating systems for controlled and precise heating with MolyCom[®], UltraBoard[®] & UltraVac[®]
- High power - electrical output ($\geq 25 \text{ W/cm}^2$)
- Dimensions of panels:
for example: 1,000 x 600 x 125 mm
- Dimension of cylinders:
for example: $\varnothing 1,500 \text{ mm} \times \text{H } 1,600$
- Other dimensions, shapes and customized production on request
- All accessory parts such as holders, connecting bands and other customized parts can also be supplied
- Fully compatible systems to other comparable manufacturers design configurations

M.E.SCHUPP MOLYCOM[®]-MOLYTEC[®] ACCESSORY



HEATING
INSULATION
MEASURING

PASSION - enthusiasm & commitment
for High Temperature Technology

Quality, service and competitive price are the points that characterize the benefits offered by M.E.SCHUPP® and make us a genuine alternative to other well-known major companies. What really pleases and satisfies our customers is the passion we show for our work. Talk to our employees and you will find that they are passionate about High Temperature Technology and this transfers into their commitment to your inquiry, order and application.



M.E.SCHUPP ULTRABOARD® & ULTRAVAC® 1,600 - 1,850

Insulating boards, shapes & cylinders made of polycrystalline (PCW) mullite/ Al_2O_3 wool from 1,250°C to 1,850°C application temperature



UltraBoard® and UltraVac® is mainly used for electrically heated industrial & laboratory furnaces and kilns.

- Genuine alternative to conventional amorphous ceramic fibers, shotfree
- Long service life due to very low shrinkage, high dimensional stability
- Thicknesses from 20 mm to 100 mm
- Standard size: 900 x 600 mm for boards
- Special material options with 99% Al_2O_3
- At 1,250°C pre-sintered boards, panels and shapes also available ("HF")
- Complete prefabricated furnace sets and linings available as customized products on request
- UltraCement® Adhesives, Coatings, FiberPlast from 1,200°C to 1,800°C
- CeraSetter® light weight sintering setter from 1,100°C to 1,700°C



M.E.SCHUPP ITM-FIBERMAX® 1,600

Premium polycrystalline (PCW) mullite/ Al_2O_3 wool, needed blankets and modules up to 1,600°C application temperature (1,650°C)



Blankets and modules are mainly used for gas fired industrial furnaces. Blankets can be used as primary material for production of modules.

Bulk Wool is used as rawmaterial for the production of vacuum formed shapes and boards.

- Genuine alternative to conventional amorphous ceramic fibers, shotfree
- Products: wool, needed blankets, modules
- Thickness from 6 up to 350 mm
- Optimum energy economy and temperature resistant up to 1,600°C (1,650°C)
- Long service life due to extremely low shrinkage
- Bulk densities from 100 - 200 kg/m³
- Very high resilience capacity
- Al_2O_3 content: standard grade 72% (mullite) and special grade 95%



HEATING
INSULATION
MEASURING

SERVICE - personal, direct,
competent & flexible

The employees at M.E.SCHUPP® Service make your business their own. In a highly qualified manner, they develop together with you the optimum economic solution to meet the needs of your applications. Benefit from the advantages of a typical family company: competent and professional staff providing fast and flexible service, in an appreciative and friendly manner. Convince yourself of our efficiency, effectiveness and personal service and ask for our special offer for you.



M.E.SCHUPP PTCR®

Process temperature control rings
from 660°C to 1,750°C



M.E.SCHUPP CERALAB®

Ceramic laboratory crucibles and boats for elemental analysis
C+S / N+O in steel, non-ferrous metals, cement, minerals, coal
and petroleum products.



- Precise recording of the 3D temperature distribution and firing and time condition profile inside the furnace / kiln.
- Very simple and economic handling
- Display and monitoring of firing/sinter processes via individual ring temperatures (RT)
- Measurement result tolerances +/- 3°C or better
- 6 ring-types:

| | | |
|---------|---------|-----------|
| RTC-AQS | 660°C | - 1,000°C |
| ETH | 850°C | - 1,100°C |
| LTH | 970°C | - 1,250°C |
| STH | 1,130°C | - 1,400°C |
| MTH | 1,340°C | - 1,520°C |
| HTH | 1,450°C | - 1,750°C |
- Special micrometer with USB interface is available



CeraLab® Laboratory Crucibles

- Maximum application temperature $\geq 2,000^{\circ}\text{C}$
- High thermal shock resistance
- Typical alloy: 80% SiO_2 , 20% Al_2O_3
- Density: 1.8 bis 2.3 g/cm³
- Standard dimension:
Ø 25 mm, H 25 mm (stackable)
- Bending strength: 5 Mpa
- Thermal expansion coefficient:
4 to 4,8x10⁻⁶K⁻¹

CeraLab® Laboratory Boats

- Maximum application temperature: 1,500°C (non adhering)
- Typical alloy: from 35% to 99% Al_2O_3
- Standard dimension: L 89 mm, W 13 mm, H 10 mm
- Special dimensions on customer demand



APPRECIATIVE - honesty,
fairness and partnership

The M.E.SCHUPP® management team. Efficiency and the trust of our customers, and joy in how we perform, is what motivates us. Our conviction ensures we act according to the model of the „respectable businessman“: We strive for long lasting working relations between your and our employees. „Efficient use not waste“ is our principle in dealing with material and energy. Honesty, fairness and frankness are the foundation on which we stand.



OVERVIEW - Technical Data

MOLYCOM®-ULTRA 1,700 / 1,800 industrial standard / 1,900 (on demand) industrial standard

| | MolyCom®-Ultra 1,700 | MolyCom®-Ultra 1,800 |
|---|---------------------------|---------------------------|
| Density | 5.8 kg/dm ³ | 5.8 kg/dm ³ |
| Bending strength at 20°C | 350-450 N/mm ² | 350-450 N/mm ² |
| Porosity | <1% | <1% |
| Max. element temperature (under air) | 1,700°C | 1,800°C |
| Max. furnace/kiln temperature (under air) | 1,600°C | 1,700°C |

| Size | Ø d | Ø c | Lu | Le | a | f | g |
|-------|-----|-----|---------|----------|----|-----|----|
| 3/6 | 3 | 6 | 50-400 | 50-400 | 25 | 25 | 15 |
| 4/9 | 4 | 9 | 50-400 | 50-400 | 25 | 25 | 15 |
| 6/12 | 6 | 12 | 125-800 | 125-1400 | 50 | 45 | 25 |
| 9/18 | 9 | 18 | 280-800 | 125-1400 | 60 | 75 | 30 |
| 12/24 | 12 | 24 | 280-800 | 125-1400 | 80 | 100 | 40 |

Please consult our datasheet or ask us for other shapes and dimensions

MOLYCOM®-HYPER 1,800 HIGH PURITY

| | MolyCom®-Hyper 1,800 |
|---|---------------------------|
| Density | 5.8 kg/dm ³ |
| Bending strength at 20°C | 350-450 N/mm ² |
| Porosity | <1% |
| Max. element temperature (under air) | 1,820 °C |
| Max. furnace/kiln temperature (under air) | 1,700 °C |

| Size | Ø d | Ø c | Lu | Le | a | f | g |
|------|-----|-----|---------|---------|----|----|----|
| 3/6 | 3 | 6 | 50-800 | 50-500 | 25 | 25 | 15 |
| 4/9 | 4 | 9 | 50-700 | 50-650 | 25 | 25 | 15 |
| 6/12 | 6 | 12 | 125-700 | 125-700 | 50 | 45 | 25 |

Please consult our datasheet or ask us for other shapes and dimensions

MOLYTEC® HEATING SYSTEMS 1,650°C

A combination of MolyCom®-Ultra or Hyper heating elements with UltraBoard® or UltraVac® produced and adjusted on customer request. Dimensions for example: 1,000 x 600 mm (panels); Ø 1,500 mm, H 1,600 mm (cylinder)

ULTRABOARD® & ULTRAVAC® 1,260°C - 1,850°C

| Max. temp./ density | 1,260/400 | 1,400/320 | 1,600/400 | 1,650/400 | 1,750/400 | 1,800/400 | 1,800/700 | 1,850/400 |
|------------------------------------|--|---------------------|-----------------------|---|------------------------|------------------------|------------------------|------------------------|
| SiO ₂ (%) | 54 | 54 | 34 | 32 | 28 | 25 | 25 | 15 |
| Al ₂ O ₃ (%) | 46 | 30* | 65 | 68 | 72 | 75 | 75 | 85 |
| Thermal conductivity | 0.16 W/mK (800°C) | 0.26 W/mK (1,200°C) | 0.22 W/mK (1,200°C) | 0.28 W/mK (1,400°C) | 0.29 W/mK (1,400°C) | 0.30 W/mK (1,400°C) | 0.38 W/mK (1,400°C) | 0.38 W/mK (1,400°C) |
| W/mK | 4 % (1,200°C / 24h) | 4 % (1,400°C / 24h) | 0,5 % (1,600°C / 24h) | -0,6 % (1,600°C / 24h) | -0,1 % (1,700°C / 24h) | -0,3 % (1,700°C / 24h) | -0,7 % (1,700°C / 24h) | -0,4 % (1,800°C / 24h) |
| Standard dimensions (mm) | 1,000 x 500 x (20; 25; 30; 40; 50; 60) | | | 900 x 600 x (20; 25; 30; 40; 50; 60; 80; 100) | | | | |

Subject to modifications

On request available: UltraBoard® A 99: 1,650/350 (Al₂O₃ = 99%)

* ZrO₂: 16%

FIBERPLAST® 1,800°C

| | Al ₂ O ₃ | Density [kg/m ³] | Type of Packaging | Comments |
|------------------|--------------------------------|------------------------------|-------------------|---|
| FiberPlast 1,800 | 80% | 1,250 | 1kg; 4kg; 15kg | Ready to use, wet moldable for repair & maintenance |

ITM-FIBERMAX® BULK AND NEEDED BLANKETS 1,600°C

| | Al ₂ O ₃ | Density [kg/m ³] | Thermal conductivity [W/mK] | Thickness* [mm] | Sizes [mm] | Type of Packaging | Comments |
|----------------------|--------------------------------|------------------------------|-----------------------------|-----------------|--------------|-------------------|--------------------|
| Bulk Wool | 72% + 95% | | | | | 10 kg bag | unchopped/ chopped |
| Blanket 1,600/100 | 72% | 100 | 0.42 W/mK (1,200°C) | 12.5 25 | 610 x 7,200* | roll | needed |
| Blanket 1,600/130 | 72% | 130 | 0.36 W/mK (1,200°C) | 12.5 25 | 610 x 7,200* | roll | needed |
| Blanket 1,600/160 | 72% | 160 | | 12.5 25 | 610 x 7,200* | roll | needed |
| Blanket 1,600/100-95 | 95% | 100 | | 12.5 25 | 610 x 1,200 | sheets | needed |
| Blanket 1,600/130-95 | 95% | 130 | | 12.5 25 | 610 x 1,200 | sheets | needed |

* Please consult our data sheets or ask us for other sizes and dimensions

ITM-FIBERMAX® PCW MODULES 1,500°C - 1,600°C

| | Al ₂ O ₃ | Density [kg/m ³] | Thermal conductivity [W/mK] | Thickness* [mm] | Sizes [mm] | Type of Packaging | Comments |
|-----------------|--------------------------------|------------------------------|-----------------------------|-----------------|-------------------------|-------------------|----------------------------------|
| 1,500°C modules | 54% | 200 | 0.28 W/mK (1,200°C) | | 300 x 300 and 300 x 600 | volume dependet | Customized production on request |
| 1,550°C modules | 61% | 150 | 0.34 W/mK (1,200°C) | 100 - 350 | | | |
| 1,600°C modules | 72% | 100 - 200 | 0.42 - 0.28 W/mK (1,200°C) | | | | |

* Please consult our data sheets or ask us for other sizes and dimensions

PTCR® PROCESS TEMPERATURE CONTROL RINGS 660°C - 1,750°C

| Type | Temperature range | Color | Dimensions |
|----------|-------------------|------------|---|
| RTC-AQS | 660°C - 1,000°C | green | Ø outer: 20 mm Ø inner: 10 mm Standard height: 7 mm Special height: 3.5 mm |
| PTCR-ETH | 850°C - 1,100 °C | pale-green | |
| PTCR-LTH | 970°C - 1,250 °C | pink | |
| PTCR-STH | 1130°C - 1,400 °C | green | |
| PTCR-MTH | 1340°C - 1,520 °C | yellow | |
| PTCR-HTH | 1450°C - 1,750°C | white | |

CERLAB®

| Type | Temperature range | Color | Minimum Order Volume |
|------------------------------|-------------------------|-------|-------------------------------------|
| Ceramic Laboratory Crucibles | ≥ 2,000 °C (short-time) | white | 100,000 pieces, call order possible |
| Ceramic Laboratory Boats | 1,500 °C | white | 50,000 pieces, call order possible |

Subject to modifications



YOUR SEARCH IS OVER!

We would be pleased to help you with any technical and commercial questions you may have. Do not hesitate to contact us with your wishes, ideas and requirements. Your success is what drives us.

























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