technology and experience for advanced materials
What does Team stand for?

**Technology and experience for advanced materials**

Team is an alliance operating in the field of advanced ceramic products.

Team integrates the know-how and expertise of leading companies in development, engineering and design of machinery, plants and processes.
Team provides Research and Development

Lab Activity  Engineering  Experience  Process Development
Based on extensive knowledge and wide experience in

Structural Ceramics

Electrical Ceramics

Functional Ceramics

Refractory Ceramics
Mutual trust and strict confidentiality is self-evident for development partnerships offered by Team members.
1 Team

1.1 Concept
1.2 Members
1.3 Application fields

2 Competence and service

2.1 R&D Pilot Plant and Equipment
2.2 Engineering

3 Technical solutions offered by Team Members

3.1 Laeis
3.2 Sama
3.3 Riedhammer
3.4 Alpha Ceramics
3.5 Gaiotto
3.6 Sacmi Imola

4 Summary
1.1 Team Concept

Provider of experience and expertise for our customers in:

- Process Development
- Process and Plant Engineering
- Machinery Customisation
1.2 Team Members

- **RIEDHAMMER**
  - RESEARCH LAB
  - HEATING TREATMENTS

- **SACMI IMOLA**
  - RESEARCH AND DEVELOPMENT
  - BODY PREPARATION
  - SERVICES

- **THE NEW ALLIANCE**
  - PRESSING
  - HANDLING

- **GAIOTTO**
  - HANDLING
  - AUTOMATION

- **SAMA**
  - GRINDING MILLS
  - TAPE CASTING
  - EXTRUSION
  - ISOSTATIC PRESSING

- **LAEIS**
  - RESEARCH AND DEVELOPMENT

- **alpha ceramics**
  - RESEARCH AND DEVELOPMENT
Business

The leading manufacturer of kiln plants worldwide. Extensive and longterm experience in the firing of tableware and sanitary ware, anodes and cathodes, refractory, electronical and technical ceramics.

<table>
<thead>
<tr>
<th>Riedhammer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location:</td>
</tr>
<tr>
<td>Founded:</td>
</tr>
<tr>
<td>Employees (2007):</td>
</tr>
<tr>
<td>Turnover (2007):</td>
</tr>
</tbody>
</table>
1.2.2 **Team Members: SAMA**

**Business**
- Shaping machinery for extrusion, isostatic pressing, high pressure and taped casting.
- Surface treatment such as fettling and glazing machines and finally automation for ceramic factories.

<table>
<thead>
<tr>
<th><strong>SAMA</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location:</strong></td>
<td>Weissenstadt (D)</td>
</tr>
<tr>
<td><strong>Founded:</strong></td>
<td>1996</td>
</tr>
<tr>
<td><strong>Employees (2007):</strong></td>
<td>110</td>
</tr>
<tr>
<td><strong>Turnover (2007):</strong></td>
<td>approx. € 20 million</td>
</tr>
</tbody>
</table>
1.2.3 **Team Members:** **LAEIS**

### Business

- Hydraulic presses for ceramic industry, refractory industry, building materials industry, salt industry and many others
- Auxiliary equipment for presses
- Plant engineering
- Plant components & complete plants

### LAEIS GmbH

<table>
<thead>
<tr>
<th><strong>Location:</strong></th>
<th>Wecker (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Founded:</strong></td>
<td>1860</td>
</tr>
<tr>
<td><strong>Employees (2007):</strong></td>
<td>71</td>
</tr>
<tr>
<td><strong>Turnover (2007):</strong></td>
<td>approx. € 24 million</td>
</tr>
</tbody>
</table>
1.2.4 Team Members: Alpha Ceramics

Business
- Material & process engineering
- Development & optimization of technologies for body preparation, shaping and firing
- Toll and niche production
- Customized process and product development

Alpha Ceramics

<table>
<thead>
<tr>
<th>Location:</th>
<th>Aachen (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Founded:</td>
<td>1998</td>
</tr>
<tr>
<td>Employees (2007)</td>
<td>10</td>
</tr>
<tr>
<td>Turnover (2007)</td>
<td>approx. € 1.3 million</td>
</tr>
</tbody>
</table>
1.2.5 **Team Members:**

**GAIOTTO** Automation

### Business

**Development**, design and manufacturing of high automatised plant for plastic and ceramics industries.

### GAIOTTO Automation

<table>
<thead>
<tr>
<th>Location:</th>
<th>Vaiano Cremasco (I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Founded:</td>
<td>1996</td>
</tr>
<tr>
<td>Employees (2007)</td>
<td>90</td>
</tr>
<tr>
<td>Turnover (2007)</td>
<td>approx. € 20 million</td>
</tr>
</tbody>
</table>
Business

Manufacturing of machines and complete plants for the Ceramics, Beverage & Packaging, Processing and Plastics industries.

SACMI Imola (Head Quarters)

<table>
<thead>
<tr>
<th>Location:</th>
<th>Imola (I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Founded:</td>
<td>1919</td>
</tr>
<tr>
<td>Employees (2007):</td>
<td>~ 1000</td>
</tr>
<tr>
<td>Turnover (2007):</td>
<td>approx. € 700 million</td>
</tr>
</tbody>
</table>
### 1.3 Application Fields

**Team Members** are leaders in:

<table>
<thead>
<tr>
<th>Structural Ceramics</th>
<th>Functional Ceramics</th>
<th>Electrical Ceramics</th>
<th>Refractory Ceramics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main characteristics:</td>
<td>Main characteristics:</td>
<td>Main characteristics:</td>
<td>Main characteristics:</td>
</tr>
<tr>
<td>strength, hardness, abrasion / deformation resistance, density and porosity</td>
<td>magnetic, chemical, optical and nuclear properties; biological inertness or surface activity</td>
<td>electrical conductivity or resistance, magnetic properties, dielectric values, piezoelectricity</td>
<td>thermal insulating, thermal shock resistance and high temperature strength</td>
</tr>
</tbody>
</table>

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![Images of various ceramic applications](image1.jpg) ![Images of various ceramic applications](image2.jpg) ![Images of various ceramic applications](image3.jpg) ![Images of various ceramic applications](image4.jpg)
1.3 Application Fields: Structural Ceramics

Structural ceramics are dense or porous, have high strength, remain hard and resist abrasion and deformation even at high temperatures.

Product examples

- Kiln rollers
- Armour
- Sealings, valves
- Grinding tools, break discs
- Filter membranes
- Insulating and climate regulating components
1.3 Application Fields: Functional Ceramics

Functional ceramics are defined by magnetic, chemical, optical and nuclear properties, biological inertness or surface activity.

Product examples
- catalysts, heat exchanger, packings, tubes, pumps,
- optical windows, absorber,
- bioceramics, implants, dental ceramics
1.3 Application Fields: Electrical Ceramics

Electrical ceramics are mainly defined by electrical conductivity or resistance, magnetic properties, dielectrical values, piezoelectricity.

Product examples

- superconductors, heating elements, varistors, thermistors, sensors,
- PTC substrates
- insulators
- computer chip components, microwave components, piezoceramics, ferrites
1.3 Application Fields: Refractory Ceramics

Refractory ceramics are mainly defined by good strength at high temperature, thermal shock resistance, thermal insulating properties etc.

Product examples
- bricks, plates, mats
- kiln furnitures
- jet/rocket nozzles, space applications
- sliding gates
- crubicles, thermal shields
2 Competence and Service

Development

Riedhammer Pilot Plant

Alpha Ceramics R&D Center + Pilot Plant

Sacmi Imola Laboratories

Team is the partner for machinery and process development in the field of advanced ceramic, providing customized and proven technical and technological solutions.
2.1 Competence and Service: Research and Development

In order to engineer a plant specific material properties must be defined.

For this purpose Team provides extensive knowledge, wide experience and research facilities in Team members pilot plants and labs.

Process engineering focuses on design, operation and maintenance.
2.1.1 Competence and Service: Riedhammer Pilot Plant

Application Center:

- Thermal analysis of ceramic products to determine optimized process parameters
- Sintering processes in oxidizing, inert and reducing atmospheres in electrically heated kilns
- Presintering and high temperature firing processes in rotary kilns, shuttle and chamber kilns and in a roller hearth kiln
- Calculations on heat transfer with computer simulations
- Co-operation with universities
2.1.1 Competence and Service: Riedhammer Pilot Plant

Equipment:

Thermal analysis
- Thermogravimetry
- Dilatometry
- Differential thermal analysis
2.1.1 Competence and Service: Riedhammer Pilot Plant

Equipment:

2 Rotary kilns for an application temperature of 1500 °C

- Directly gas heated
  - Useful length: 3.00 m
  - Useful diameter: 0.24 m

- Indirectly electrically heated
  - Useful length: 1.80 m
  - Useful diameter: 0.24 m

Firing processes in different atmospheres
2.1.1 Competence and Service: Riedhammer Pilot Plant

Equipment:

1 Electrically heated top hat kiln:

- firing temperature: 1450 °C
- useful volume: 33 ltr.
- de-bindering and sintering processes in O₂-, N₂-atmospheres, computer controlled

6 electrically heated chamber kilns
2.1.1 Competence and Service : Riedhammer Pilot Plant

Equipment:

Fiber lined gas heated shuttle kiln:

firing temperature: 1600 °C
useful volume: 600 ltr.
de-bindering and firing processes
in oxidizing, neutral and reducing atmospheres
2.1.1 Competence and Service : Riedhammer Pilot Plant

Equipment:

Gas heated high temperature chamber kiln

firing temperature: 1800 °C
useful volume: 150 ltr.
2.1.1 Competence and Service : Riedhammer Pilot Plant

Equipment:

Gas heated roller hearth kiln

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>firing temperature</td>
<td>1500 °C</td>
</tr>
<tr>
<td>kiln length</td>
<td>13.45 m</td>
</tr>
<tr>
<td>useful width</td>
<td>0.4 m</td>
</tr>
<tr>
<td>useful height</td>
<td>0.2 m</td>
</tr>
<tr>
<td>passage time</td>
<td>0.5 h to 24 h</td>
</tr>
</tbody>
</table>
2.1.1 Competence and Service: Riedhammer Pilot Plant

Application Center: computer simulations

- Calculations of transient thermal conduction
- Dimensioning of insulations
- Heat transfer calculations
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

Activities:

- Materials
- Technology
- Engineering
- Process

Bridging different approaches

Scientific Research
Industrial R & D
Ceramic Industry
2.1.2 Competence and Service : Alpha Ceramics R&D + Pilot Plant

Activities:

- Comprehensive knowledge of technologies for body preparation, shaping and firing
- Combined material and process engineering
- Characterization of raw materials, intermediates and finished products
- Body development
- Process development and optimization
- Machine and plant design
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

Equipment:

Spray dryer

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Height</td>
<td>11 m</td>
</tr>
<tr>
<td>Water evaporation</td>
<td>180 l/h</td>
</tr>
</tbody>
</table>
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

Equipment:

Hydraulic Press HPF 630

- Big selection of moulds, many of them vacuum equipped
- Pressing force: 630 t
- Filling height: 800 mm
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

Equipment:

Hydraulic Press
Alpha 1500-120

Big selection of moulds, most of them vacuum equipped

<table>
<thead>
<tr>
<th>Pressing force</th>
<th>1500 t</th>
</tr>
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<tbody>
<tr>
<td>Filling height:</td>
<td>120 mm</td>
</tr>
</tbody>
</table>
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

**Equipment:**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chamber Dryer / Shuttle Kiln</td>
<td></td>
</tr>
<tr>
<td>Dryer volume:</td>
<td>11.6 m³</td>
</tr>
<tr>
<td>Kiln volume:</td>
<td>2.3 m³</td>
</tr>
<tr>
<td>Max. kiln temperature:</td>
<td>1450 °C</td>
</tr>
</tbody>
</table>
2.1.2 Competence and Service: Alpha Ceramics R&D + Pilot Plant

**Equipment:**

**Roller dryer / Roller kilns**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Dryer length:</strong></td>
<td>6.6 m</td>
</tr>
<tr>
<td><strong>Max. temperature:</strong></td>
<td>170 °C</td>
</tr>
</tbody>
</table>

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<table>
<thead>
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<tbody>
<tr>
<td><strong>Kiln 1 length:</strong></td>
<td>24.2 m</td>
</tr>
<tr>
<td><strong>Max. temperature:</strong></td>
<td>1450 °C</td>
</tr>
</tbody>
</table>

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<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Kiln 2 length:</strong></td>
<td>13.2 m</td>
</tr>
<tr>
<td><strong>Max. temperature:</strong></td>
<td>1650 °C</td>
</tr>
</tbody>
</table>
2.1.2 Competence and Service : Alpha Ceramics R&D + Pilot Plant

Equipment:

Top-hat Kiln

- Electrically heated
- Temperature max. 1750 °C
2.1.3 Competence and Service: Sacmi Imola Facilities

Equipment:

- Analitical laboratory
- Technological laboratory
- Plant engineering
2.1.3 Competence and Service : Sacmi Imola

Equipments:

- Electron microscope
- X-ray difractometer
- Plasma spectrometer
- Mercury porosimeter
- Laser granulometer
2.2 Competence and Service: Engineering

Process Engineering and Layout:

- Feasability Studies
- Study of local Conditions
- Material Testing
- Operational Flowcharts
- Planning of Utilities
- Definition of Machinery
Team offers engineering and supply of plant components for:

- **Body Preparation**
- **Heat Treatment**
- **Shaping**
- **Automation**
- **Finishing**
3.1 Technical Solutions: Riedhammer Competences

Research & Development in Heat Treatment

- Modelling heat transfer conditions
- Computersimulations
- Process engineering
- Material research
- Co-operations with institutes
3.1 Technical Solutions: Riedhammer Competences

Kiln design, manufacturing and installation
3.1 Technical Solutions: Riedhammer Competences

Activities:

- Research & Development
- Kiln Plant Engineering
- Heat Treatment
- Plant Customisation
3.2 Technical Solutions : Sama Competences

Activities:

- Shaping
- Surface Treatment
- Mechanical Finishing
- Automation Machinery
3.2 Technical Solutions: Sama Competences

- Turning Machines
- Vacuum Extruder
- Glazing Machines
3.2 Technical Solutions: Sama Competences

- Isostatic Press
- High Pressure Casting
- Tape Caster
3.3 Technical Solutions: Laeis Competences

Activities:

- Research & Development
- Shaping
- Plant Engineering
3.3 Technical Solutions: Laeis Competences

Pressing
3.3 Technical Solutions: Laeis Competences

Plant engineering
3.4 Technical Solutions: Alpha Ceramics Competences:

Activities:

- Research & Development
- Body Preparation
- Shaping
- Heat Treatment
- Toll Production
3.4 Technical Solutions: Alpha Ceramics Competences

Analytical services

- Thermal analysis
- Particle size distribution
- Rheological analysis
- Determination of density
- Determination of bending strength
- Optical microscopy
3.4 Technical Solutions: Alpha Ceramics Competences

Technical services

Technologies: spray drying, mixing, shaping, drying and firing

- Process development & optimization
- Scaling up
- Small scale production
- Know how transfer
3.5 Technical Solutions: Gaiotto Competences

Activities:

Machinery Automation

Handling

Customization of robotize application
3.6 Technical Solutions: Sacmi Imola Competences

Activities:

Research & Development

Body Preparation

Automation Machinery
3.6 Technical Solutions: Sacmi Imola Competences
As a strong Alliance with Experience and Know-How

Team provides

- Outstanding R&D facilities to assist with process development and optimization

- Cutting-edge process synergy for the production of technical ceramics, from raw material preparation to shaping and firing with precision quality control at every stage of production

- A wide range of customised machinery and production lines

- Confidentiality
Thank you for your kind attention!