Unique Low Mass Sintering Accessories for MIM and CIM Applications

Presented By: David P. Hamling
ZIRCAR Ceramics, Inc.

MIM 2019
Lake Buena Vista, FL
History

- 100 N. Main Street, Florida, New York 10921 USA
- Successor in Interest to ZIRCAR Products, Inc.
- ZPI Founded 1974 by Bernie Hamling
- ZIRCAR Ceramics, Inc., Incorporated June 2000
- Current Owners: David Hamling and Phil Hamling
Assets - Sales - Employees

Manufacturing:
Original ZIRCAR Products, Inc. Factory
Recently Expanded to 30,000 sq.ft.
Recent Acquisition of 20,000 sq.ft factory space - BMR
Recent 10,000 sq.ft expansion - BMR

Admin:
Original “150 year old Victorian Mansion” Offices.

Warehouse: 6000 sq. ft.
Tool Shop: 1500 sq.ft.
Total Area = 75,000 sq. ft.

Sales: USD 10 Million
Employees: 50 Full-Time
Knowledge Through Experience

- Executive Management – 75+ Man Years Combined Experience.

- Department Managers & Supervisors 10+ years Individual Experience
It’s a family affair!

- In 20011 the third generation of the Hamling family joined the company.
- **Phil B Hamling** - Key Account / OEM Sales
- **Cole Hamling** - Production Manager
Products

- Wide range of application solutions based upon high temperature ceramic fiber technology
- High temperature stability & refractoriness
- Possible through the properly engineered combination of raw materials
Top Markets Served

- Injection-Molded Metal and Ceramic Powders MIM / CIM
- Electro / Technical Ceramics
- Secondary Aluminum - Sheet and Die Casting
- Electro-Mechanical Devices
- Gov’t & Corp. R&D
- OEM Rapid-Cycle Furnace Builders

- OEM Analytical Device Manufacturer
- Sputtering Target Makers
- High-Temperature Fuel Cells
- Oxide Crystal Growers
- Fiber Optic Fiber Producers
- Many More!!!!!!
<table>
<thead>
<tr>
<th>Composition Al₂O₃ / SiO₂</th>
<th>Fiber Type ***</th>
<th>Binder System</th>
<th>Continuous Operating Temp. C</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% / 20%</td>
<td>ALBF</td>
<td>SiO₂</td>
<td>1700 to 1825</td>
</tr>
<tr>
<td>85% / 15%</td>
<td>ALBF</td>
<td>SiO₂</td>
<td>1650</td>
</tr>
<tr>
<td>59% / 41%</td>
<td>ASBF</td>
<td>SiO₂</td>
<td>1420</td>
</tr>
<tr>
<td>35% / 65%</td>
<td>ASBF</td>
<td>SiO₂</td>
<td>1260</td>
</tr>
</tbody>
</table>

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<th>Fiber Type ***</th>
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</thead>
<tbody>
<tr>
<td>98.4% / 1.6%</td>
<td>ALBF</td>
<td>Al2O3</td>
<td>1700</td>
</tr>
<tr>
<td>97% / 3%</td>
<td>ALBF</td>
<td>Al2O3</td>
<td>1600</td>
</tr>
<tr>
<td>68% / 32%</td>
<td>ASBF</td>
<td>Al2O3</td>
<td>1063</td>
</tr>
</tbody>
</table>

***ALBF = Polycrystalline Alumina, 96% Al₂O₃ 4% SiO₂, > 50% Alpha Al₂O₃

***ASBF = Vitreous Alumina Silica, 50% Al₂O₃ 50% SiO₂
Rigid Products

Standard Boards:

**Densities:** 0.26 to 0.80 g/cc
(16 - 50 pcf)

**Sizes:**
- **Thickness:**
  - 6 - 100 mm
  - (1/8 to 4 in.)
- **Width x Length:**
  - 305 x 457 L to 610 x 1220mm
  - (12 x 18 to 24 x 48 in.)

www.zircarceramics.com
Flexible Products

$\text{Al}_2\text{O}_3$ Blanket & Papers
  - $1650^\circ\text{C}$ Max Temp.
  - $\text{Al}_2\text{O}_3 - \text{SiO}_2$ Blanket

Papers & Textiles
  - $1260^\circ\text{C}$ Max Temp.

Die cut firing separators
Cements & Rigidizers

High Temperature Bonding & Hardening Agents

Compositions:

- 99+% Al₂O₃
- Al₂O₃ – SiO₂
- SiO₂
MIM Applications

Typical Applications:

- Saggar veneers
- Boat liners
- Firing Setters
- Sintering Fixtures
- Thermal Insulation In H₂ Atmosphere Furnaces with temperatures as high as 1700°C

Challenges:

- Flatness Requirements
- Complex part topographies
- Drag induced distortion
- Contamination issues
- Effective Thermal Insulation
ZAL-45AA

Product Features

- High Purity Al₂O₃
- 70% Open Porosity
- Colloidal Al₂O₃ particles
- Low Mass
- **Superior Machinability & Re-machinability!**

Benefits

- Stable in Sintering Atmospheres H₂ / vacuum
- Enables Production Of High-Density Parts
  - complete binder burnout
  - full sintering
- Low Distortion Of Complex Parts – no sticking
- Eliminates Cross Contamination
WEIGHT LOSS vs TIME at 1450°C in HYDROGEN

ZAL-15AA, ECO-20AA, ZAL-45AA, ZAL-60AA
LENGTH and WIDTH SHRINKAGE vs TIME
at 1450°C in HYDROGEN

SHRINKAGE

TIME, hr.

SALI
AL 25/1700
ZAL-15AA
ECO-20AA
ZAL-45AA
ZAL-60AA

Zircar CERAMICS
Machinability

Rapid Prototyping and efficient mass production.

Precision Machined Components

• ZCI owns 4 CNC Routers

• Well-equipped finishing department

• Tightest tolerances in a ceramic fiber product.
Precision Machined Fixtures
New Developments

• “Naneramic Infusion” – Custom-made fixtures with a proprietary hardening treatment for AA products.
• Increased setter life through enhanced wear resistance.
• More firing cycles.
• Lower cost of ownership in tough fixturing applications.
Compressive Resistance
ZAL-45AA with Al₂O₃ Infusion A Vs. Standard ZAL-45AA

Note: ZAL-45AA Al₂O₃ Infusion A data represents the average of three samples measured in Development Project 13-004. ZAL-45AA Standard data represents the data published on ZCI webpage.
Flexural Strength
ZAL-45AA with Al₂O₃ Infusion A Vs. Standard ZAL-45AA

Load Applied Normal To Fiber Plane

Note: ZAL-45AA Al₂O₃ Infusion A data represents the average of three samples measured in Development Project 13-004. ZAL-45AA Standard data represents the data published on ZCI webpage.
Hardness
ZAL-45AA with Al₂O₃ Infusion-A Vs. Standard ZAL-45AA

Note: ZAL-45AA Al₂O₃ Infusion-A data represents the average hardness of the sample measured in Development Project 13-004. ZAL-45AA Standard data represents the average hardness of a sample from Lot#: 59-207
Low Mass Sintering Fixtures With NANERAMIC INFUSION

Samples Available During Tabletop Reception
Thank You

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