

# **ZIRCAR Refractory Composites, Inc.**

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# High Temperature Refractory Composites and Related Products for use as Thermal, Electrical and Structural Insulation.

**ZIRCAR Refractory Composites, Inc.** produces a comprehensive line of advanced high performance ceramic-ceramic composite materials and related products. Our materials are used around the world in the most demanding thermal, structural and electrical insulating applications ranging in temperatures from **600°C(1112°F) to 1650°C(3002°F)**. We have developed products that have become industry standards for induction melting, forging and heat treating applications, investment casting, glass processing, hot pressing, as well as many high temperature electrical applications.



# INDUCTION HEAT TREATING, MELTING AND FORGING

- **Application Information:** Refractory Sheet materials are used as Structural and Protective components in all types of Induction Melting, Heat treating and Forging equipment
- Induction Furnace Components such as Coil Support Posts, Coil Liners, Furnace Tops, Crucible Bases, Front and Back Plates. Thermal Shock Proof Coil Liners for Forging Applications, Annealer Insulation for Stainless Steel Tube and Strip
- Major Customers and Materials
  - Inductotherm, Raydyne, Alpha One, Inductoheat, Ajax Tocco Magnithermic, Pillar Induction and many other OEM and Induction Furnace Rebuilders and end users.
  - RS-100, RS-1200, RS-101, RS-201, RS-A, RS-DA, RS-Tape, RSLE-57 and RS-501



RS-100 is used as a structural component in the construction of induction melters.



RS-101 is used as a coil liner for coreless induction melters.

# INDUCTION HEAT TREATING, MELTING AND FORGING



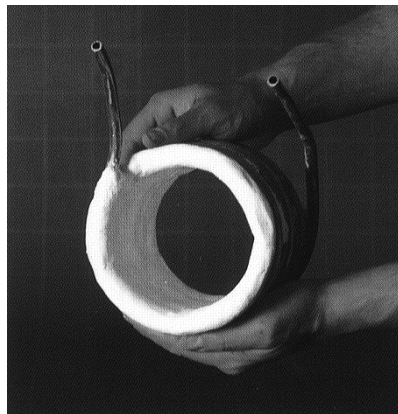
RS-201 and RS-202 Cylinders are used for Induction Coil Liners for Stainless Steel Tubing and wire annealing.



RS Cloth and RS Tape is used as Induction Coil protection wrap in custom coils



RS-501 Cylinders are used for Thermal Shock Resistant Induction Forging Liners.



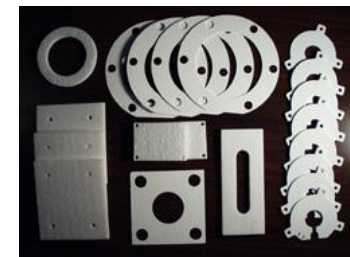
RS-A Moldable and Type RS-D are used as custom Coil Liners.

# FOUNDRY / INVESTMENT CASTING

- **Application Information:** Refractory Sheet Materials are used in Many areas of foundry and Investment applications. Their high resistance to thermal and structural wear make them ideal for applications that require increased refractory life.
- Production of High Temperature Supper-alloy, Titanium and Cobalt based Alloy for Aircraft Turbine Blades and Prosthetic Devices (Knees and Hips). RS-100 and RSLE-57 are used In the Induction Furnaces to Increase the life of the furnace and minimize Down Time,
- RS-100 Can Take Metal Splash at 1650C(3002F) without falling apart, We produce a number of Metal Containment Systems to prevent the destruction of the melter and to assist in Reclaiming lost Metal
- Major Customers Include
  - PCC Airfoils, GE Aircraft, Pratt and Whitney, Stryker, Chromalloy, Gold an Platinum Refiners



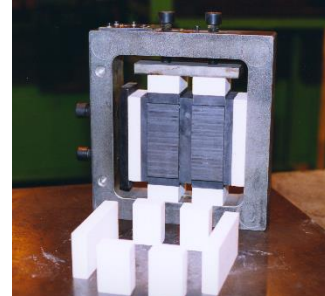
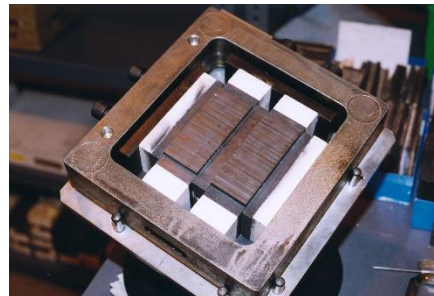
RS-100 is used as Induction Melting Rollover Furnace Tops for the Investment casting of super alloys.



RS-DA And RS-(99) Gasketing Material Used in Centrifugal Casting of Metals

# HOT PRESSING

- **Application Information:** Refractory Sheet Type RSLE-57 is used in this application as an electric insulator for induction hot pressing of diamond saw segments, brake pads, and cookware.
- RSLE-57 is an integral part of the production of hot pressed diamond segments. RSLE-57 is used as a separator to electrically and thermally insulate a metal ram from a graphite pack. It will see in excess of 1800°F with several thousands pound per square inch compression without any surface deformation.
- **Benefits:** RSLE-57 has excellent dielectric strength, good compressive strength and thermal shock resistance, and is easily machined to various shapes to tight tolerances.
  - Major Customers and Materials
    - Saint Gobain, Diamont Boart, Allied Materials(ALTM), Raybestose, Regaware, Electrolux
      - By Far the Worlds Best Materials for use as a Thermal, Electrical and Structural Insulator for the use in the Production Or Diamond Segments Sintering, Cookware Brazing and Brake Pad Annealing
      - RSLE-57 is used in many high temperature High pressure Platen Insulation.
      - RSLE-57, RS-200



# GLASS MANUFACTURERS

- **Application Information:** Refractory Sheet materials are ideal for the temperature range of many hot glass applications. It is used by many major glass manufactures in their Melting, Annealing, Tempering and Bending furnaces.
- Major Customers and Materials
  - Corning, PPG, Pilkington, World Kitchen, APP Technoglass, GE Quartz, GE Lighting, Osram Sylvania, Pittsbugh Corning, Glasstech,
    - RS Materials Are used as a Dust Free Insulation in many Glass Applications such as Hot face in Auto glass Tempering and bending Furnaces
    - RS-100 is used by Corning in All of their Glass Melting Furnaces for Making Flat Glass For TV and Computer Screens
    - RSLE-57 is used in Many Thermal Shock Applications Such as Door seals and Door Panel.
  - RS-100, RS-200, RS-1200, ZIRCAL-18, ZIRCAL-45, ZIRCAL-95, RS Tape



RS-100 used as the Hotface insulation, Electrical hookups and door seal in automotive glass tempering and bending furnaces and Deep Bend Ovens.



RS-100 is used as setout trays for hot glass

# ANALYTICAL EQUIPMENT

- **Application Information:** ZRCI Refractory Sheet materials are used by Analytical equipment manufactures that has a heat source in their equipment due to their high thermal stability and their ability to be machined by standard tooling. This allow them to be economical for Prototype as well as small quantity manufacturing.
  - Major Customers and Materials
    - LECO, Perkin Elmer, Zellwegger Analytical, Antek,
    - RS Materials are used in Many Insulating Applications in Analytical instruments such as Gas Chromatographs, Sulfur Analyzers, Infrared Dryers, Etc.
    - RS-100, RS-200, RS-1200, ZIRCAL-18, ZIRCAL-45, ZIRCAL-95, RS-99R, RS-401, Papers, Blankets

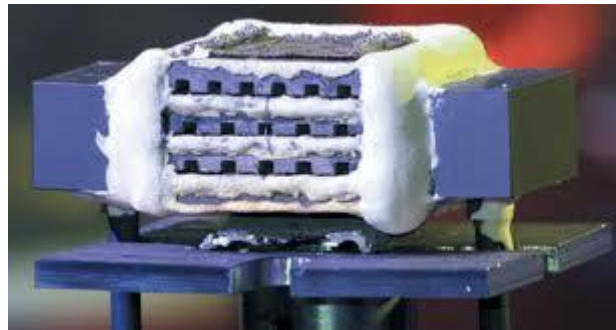


# FUEL CELL

- **Application Information:** Refractory Sheet is used in Solid Oxide Fuel cell applications. The high Alumina and high strength of RS-99R make it ideal for many high temperature fuel cell applications. The ultra pure Alumina (99+ %) is used in any reducing atmosphere without degradation of the strength due to reduction of silica. The porosity of the RS-99R does not allow Hydrogen to pass through so it has been used as separators in the reformer portion of fuel cells as structural encapsulating member.
- Major Customers Include
  - We are a Technical Partner for Siemens Westinghouse for Their Solid Oxide Fuel Cell Program, IdaTech, Ion Technology, GM, Delphi, Many other High Temperature Fuel cell and Reformer Applications
    - We produce many insulating Components that are used In Fuel Production Reformers to Flow channeling and exhaust applications, as well as many Test Stand Applications
  - RS-99R, RS-99-60, ZIRCAL-18, RSLE-57, Blankets and Papers



Siemens Solid Oxide Fuel Cell.

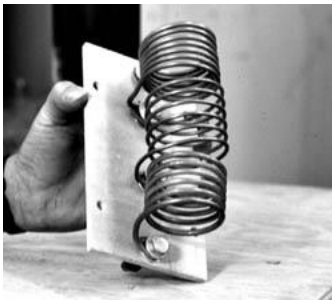


RS-99M used to seal Solid Oxide Fuel Cell.



# ELECTRICAL INSULATION

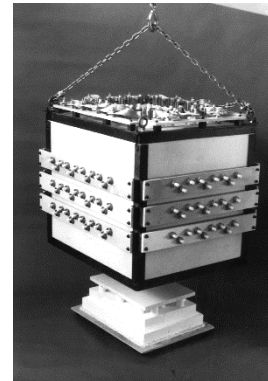
- **Application Information:** Refractory Sheet is used in Many electrical applications. It can take the shock of an electrical discharge without falling apart. Many of our materials are used by testing company's as fixtures in electrical destruction testing.
- Major Customers and Materials
  - GE Locomotive, Cushman, Approved for French Rail, Nohl Electrical,
    - RS materials are used in the Dynamic Braking Systems as Resistor Grids of Locomotive and Electric Carts
    - RS materials are used in High and Medium Current Switch Gear
    - Furnace Manufacturers will Use RS-1200 as electrical terminal. It can be taped and used as a High Temperature Electrical Terminal Board
    - RS-100, RS-200, RS-1200



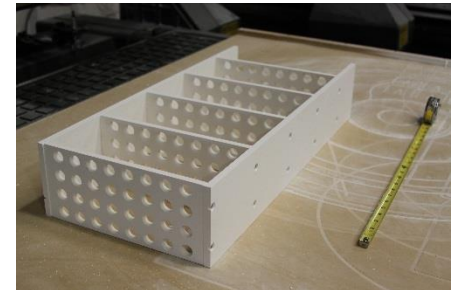
RS-100 is used as a resistor support in Golf carts and other electric powered vehicles



RS-101 Cylinder were used an eutectic insulator to prevent corrosion in a underwater oil pipeline.



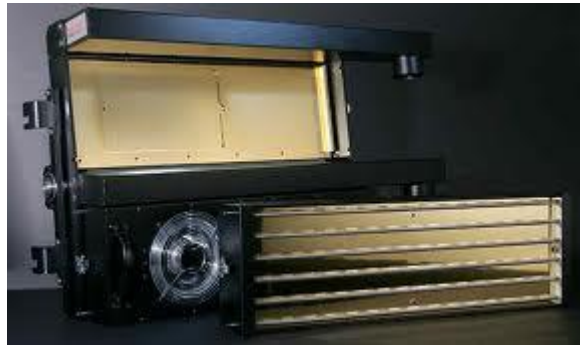
RS-100 is used in the hanger system and electrical terminal blocks in a high temperature Rapid Cycle Furnace



RSLE-57 is used as an heating element support in a high watt load heating element.

# INFRARED AND HIGH INTENSITY LIGHTS

- **Application Information:** Refractory is used by many High Intensity Spotlight Manufacturers as bulb fixtures. The RSLE-57 is ideal material to be machined into bulb supports. As the bulbs increase in temperature the fixturing material will not expand and constrict the bulb.
- Major Customers and Materials
  - Lycian, Ballentine, Corning Spotlight, Innovative industries
    - RS Materials Are used as a Dust Free Insulation in many high intensity spot light applications due to their excellent non electrically conducting properties.
    - RSLE-57 has a highly reflective white surface that has no organic content, and will not outgas or turn color when heated.
    - RS-100, RSLE-57 and RD-DR

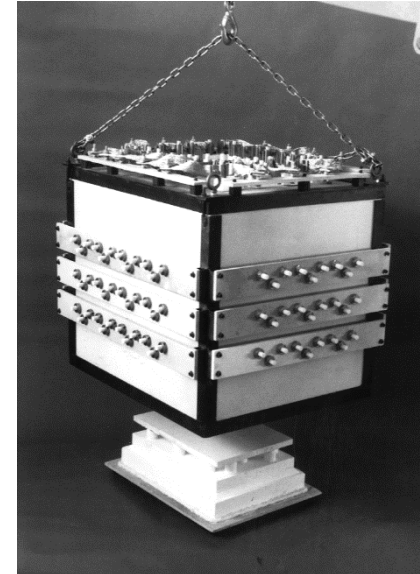


RSLE-57 use ideal for hot face insulation in Infrared Dryers due to its dust free nature and low expansion.



# STUCTURAL INSULATION

- **Application Information:** Refractory sheet is used
- Major Customers
  - ZIRCAR Ceramics, SPC Incinerator,
    - RS Materials are used as furnace shells and supports, Etc.
    - They are strong, Non conducting and are not affected by temperature like metal.
    - RS-100, RS-1200, RSLE-57



RS-1200 is used as the exterior layer of insulation on high temperature furnaces and incinerators. RS-1200 is strong and will not rust or corrode due to heating and cooling cycles

# GLASS ART AND NEON LIGHT MANUFACTURERS

- **Application Information:** Refractory Sheet materials can be used by anyone working in hot glass. Due to its high alumina properties molten glass will not stick to it.
- Major Customers
  - GHN Neon, Thousands of Glass Artist World Wide
    - Used as a Non Sticking Mold Material for the production of Neon Signs
    - Mold Mix 6 and RS-DD are used for the production of Glass and Bronze Hot Casting Molds
    - RS-100, Mold Mix 6, RS-DD



# Alumina Matrix Composites

- RS-100, RS-1200 and RS-200 Boards
- RS-101, RS-201 and RS-202 Cylinders
  - Fiber Reinforced Alumina Composites
    - 65% up to 82% Alumina
  - Medium Density
    - 1.6(100) to 2.16(130) g/cc(pcf)
  - High Strength
    - Up to 90(13,000) MPa(psi) Compressive Strength
    - Up to 69(10,000) MPa(psi) MOR
  - Excellent Electrical Properties
  - For use up to 1260C(2300F)

# Alumina Matrix Composites

- Induction Furnace Components such as Coil Support Posts, Coil Liners, Furnace Tops, Crucible Bases, Front and Back Plates
- Electrical Terminal Blocks and Supports for Electrical Resistor Grids Operating in High Temperature Environments
- Exterior Structural Insulation in High Temperature Electrically Heated and Gas Fired Furnaces and Incinerators.
- Hot Face Structural Insulation in Glass Tempering and Annealing Furnaces
- Brazing Separators and Fixtures
- General Protective Heat Shielding in Foundry Environments
- Molten Metal Splash Guards in Induction Furnaces
- Direct Replacement for Transite and Other Asbestos Cement Products
- Fireproof Structural Insulation
- Electrical Insulation for Aluminum Pot Room Ducting Systems

# Alumina Matrix Composites

- Advantages

- They have exceptional flexural and compressive strengths in the range of high temperature reinforced plastics such as G-7 and G-10 laminates and retains strength and utility to levels far exceeding maximum use temperatures of plastics.
- The mechanical properties exceed those of all calcium-silicate materials, as well as Transite and other asbestos cement materials, over all temperature ranges. They not only makes excellent replacement for rigid, asbestos containing products, but can also be employed at much higher temperatures.
- 100% inorganic, non-flammable and contains no asbestos or refractory ceramic fiber (RCF). High Alumina content makes them highly resistant to many environments, including molten aluminum and glass, and undergo no out-gassing upon heating.
- They not brittle and have high impact properties.
- They can be cut and machined with standard tooling.



# High Alumina Matrix Composites

- RS-99R, RS-99W, RS-99M, RS-99A, RS-99-60 and RS-99-45 Sheets, Cylinders and Custom Shapes
  - Fiber Reinforced Alumina Composites
    - High Purity 99+% All-Alumina
  - Various Density
    - 0.72(45) up to 2.16(130) g/cc(pcf)
  - Excellent Electrical Properties
  - For use up to 1650C(3002F)
- RS-DR, RS-DD, RS-DM and RS-DA Sheets , Cylinders and Custom Shapes
  - Fiber Reinforced Alumina Composites
    - 90% Alumina
  - Medium Density
    - 1.6(100) to 2.16(130) g/cc(pcf)
  - Non-wetting with Molten Glass
  - For use up to 1300C(2370F)

# High Alumina Matrix Composites

- Thermal insulation, supports and process fixtures in Hot Isostatic Presses (HIP) furnaces and other thermal process systems operating to 1650°C (3002°F).
- High temperature setters, supports and process fixtures for MIM, PM and other component firing.
- Thermal insulation in bright annealing furnaces and other thermal process systems with hydrogen gas atmospheres operating to 1550°C (2822°F).
- Thermal insulation, supports and fixtures for Solid Oxide Fuel Cells and other high temperature fuel cell applications .
- Backup thermal insulation in furnaces and thermal process systems operating to temperatures exceeding 2000°C (3632°F).
- Launderers, distribution boxes, pouring spouts, hot tops and other components involving molten metal contact.
- Type RS-99 is used as induction furnace components such as channel melter components, coil liners, coreless induction components, covers, tops, bases, front and back plates, coil supports, splash and coil shield.
- Rapid cycle furnace door cowls and hot face supports.
- High and low temperature gasketing.

# High Alumina Matrix Composites

- Contains no organic binders and will not smoke or produce odors when heated.
- Excellent resistance to chemical attack and are not affected by oil or water.
- High purity alumina bond making them ideal for vacuum, reducing atmospheres and other applications where silica cannot be tolerated, such as powder metal sintering, MIM, stainless steel bright annealing and many fuel cell applications.
- High electrical resistivity at elevated temperatures allows them to be used in direct contact with resistance heating elements.
- Can be constructed into near net complex shapes. They can also be machined to exacting tolerances with ordinary shop tools and equipment.
- Superior machinability and dimensional stability, plus low heat capacity, make them ideal for use as setters, supports and process fixtures in both continuous and batch firing furnaces.

# Silica Matrix Composites

- RSLE-57 Boards, RSLE-56 Moldable and RSLE-501 Cylinders
  - Fiber Reinforced Fused Silica Composites
    - 99+% Silica
  - Medium Density
    - 1.4(90) g/cc(pcf)
  - High Hot Strength
    - Up to 48(7,000) MPa(psi) Compressive Strength
    - Up to 30(4,300) MPa(psi) MOR
    - Strength Increases upon heating to 1200C(2192F)
  - Extremely Low Thermal Expansion
    - **$0.3 \times 10^{-6} \text{ }^{\circ}\text{C}$**
  - For use up to 1260C(2300F)

# Silica Matrix Composites

- Hot Press Insulation For Diamond Segments, Cookware, Brake Pads, Etc
- Induction Furnace Components such as Coil Support Posts, Coil Liners, Furnace Tops, Crucible Bases, Front and Back Plates
- Brazing Separators and Fixtures
- General Protective Heat Shielding in Foundry Environments
- Hot Flue Linings
- Non-wetting properties when used in contact with molten aluminum, zinc, lead, tin and other non-ferrous metals, making it useful in numerous casting, conveying, containing and forming applications. Ideal material for use as Filter Boxes, Dams, Spouts, Floats, Launderers, Head Boxes, Baffles, Headers, Tips, Rings, Distribution Boxes, Stoppers, Basins, Snouts, Transition & Orifice Plates and Hot Top & Ingot Mold Liners. Casting Table and Trough Liners
- **Ideal for any Thermal Shock Prone Part**

# Silica Matrix Composites

- **ZRCI Refractory Sheet Type RSLE-57** is a low expansion, high strength reinforced silica matrix composite. Designed for use as a high strength insulator in induction hot press applications, it is ideal for any application which requires a material with superior hot strength at temperatures as high as **1200°C (2192°F)**. Type RSLE-57 is an integral part of the production of hot pressed diamond segments. It is used as a separator to electrically and thermally insulate a metal ram from a graphite pack. It will see in excess of 1000°C (1832°F) with several thousand pounds per square inch compression without any surface deformation.
- **RSLE-57's exhibits a very low thermal coefficient of expansion ( $0.3 \times 10^{-6} \text{ }^\circ\text{C}$ )** which provides remarkable resistance to the thermal shock up to 1200°C (2192°F) in an oxidizing atmosphere and permits its use with rapid variation in temperature in that zone.
- Type RSLE-57's very low thermal expansion coefficient and high density combine to give it thermal shock resistance not found in other structural ceramic composite materials. These properties give it much greater life in most hot pressing and induction heating applications.
- **Type RSLE-57 is 100% organic free and contains no refractory ceramic fibers, (RCF's)**. It is readily machined to precision tolerances with conventional tooling.

# Other Material

- Calcium Silicate Boards
  - Various Density
    - 0.28(17.5) up to 1.4(85) g/cc(pcf)
- Cements, Rigidizers Puttys and Coatings
  - Zirconia
  - Alumina
  - Boron Nitride
- Flexible Materials
  - Alumina Felts and Mat
  - Alumina-Silica Papers
  - Insulating Blankets
  - Refractory Moldable Blankets
- Refractory Tapes and Cloths
  - Alumina
  - Silica