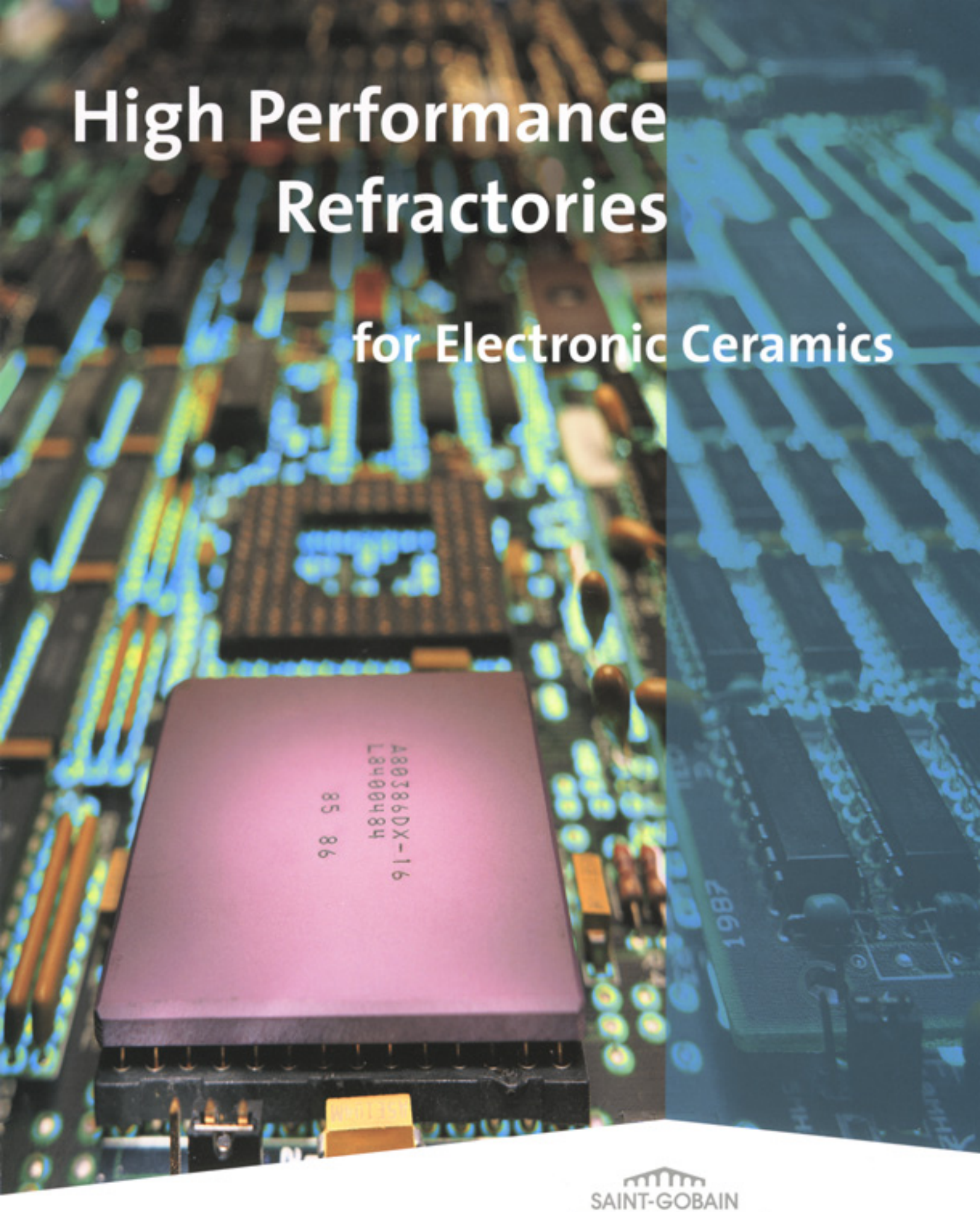
High Performance Refractories

for Electronic Ceramics



SAINT-GOBAIN
INDUSTRIAL CERAMICS

Saint-Gobain Refractories:

an integral part of today's electronics.

Electronic ceramics are integral components of numerous electronic products and packages including computers, wireless communication devices, industrial controls, consumer automotive devices, and digital switches. Saint-Gobain refractories are proven to provide superior performance in high temperature environments. They are used by electronic ceramic manufacturers of capacitors, insulators, substrates, integrated circuit packages, ferrites, piezoelectrics, and other ceramic-based products. Saint-Gobain refractories are also proven to withstand the extreme thermal demands of quartz and optical/electronic crystal manufacturing.

Saint-Gobain engineers its refractories for strength, thermal shock resistance, creep resistance, chemical compatibility, dimensional stability and minimal mass. **The result: refractories that provide maximum productivity and longer life.**

High Performance Refractories are the Result of Superior Research & Development, Engineering and Manufacturing

Advanced materials and products are manufactured in Worcester, Massachusetts. The facility is ISO-9002 certified and utilizes statistical process control (SPC) for consistent quality and continuous improvement. Customers interact directly with application engineers. As a result, products are custom designed to meet or exceed customer requirements. Saint-Gobain's unique team of application engineers and material scientists can design, engineer and deliver high performance refractories for the most challenging applications.

Scientists are constantly working to develop new products or improve existing ones at Saint-Gobain's world-class research and development center in Northboro, Massachusetts. State-of-the-art equipment and capabilities include:

- Localized chemistry and microscopy with a scanning electron microscope (SEM)
- X-ray diffraction for phase analysis
- X-ray radiography for non-destructive evaluation
- Wet chemistry
- Mechanical testing at room and high temperatures
- Creep, tension and compression measurements
- Carbon, nitrogen and oxygen analysis
- Particle size analysis
- Oxide firing capabilities to 1700°C
- Atmosphere firing to 2100°C
- Finite element analysis (FEA)

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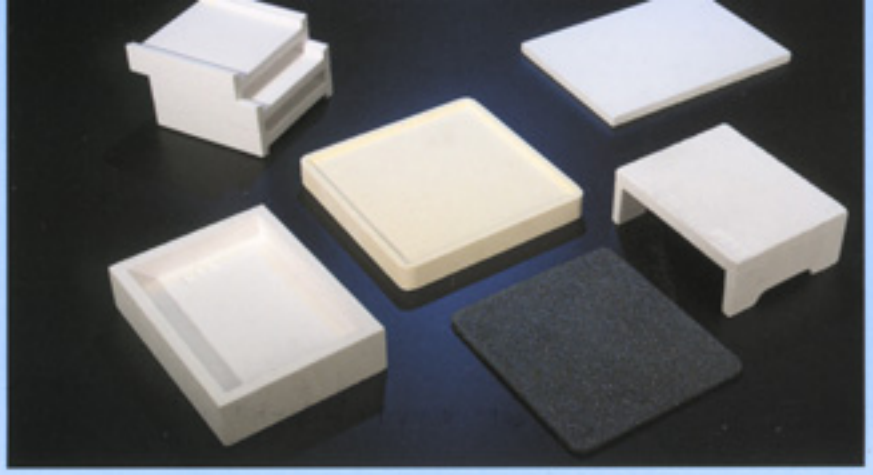


High strength alumina and silicon carbide products provide excellent creep resistance at temperature and maintain flatness after repeated cycling.

High Performance Refractories for Substrates

Saint-Gobain's refractories are designed to yield flat, defect-free substrates. Compositions are formulated to provide high strength at temperature and a smooth setting surface.

These properties result in excellent flatness retention after repeated cycling. Saint-Gobain can also grind setting surfaces to .001 inch/inch (.1%) for the ultimate flatness requirements.

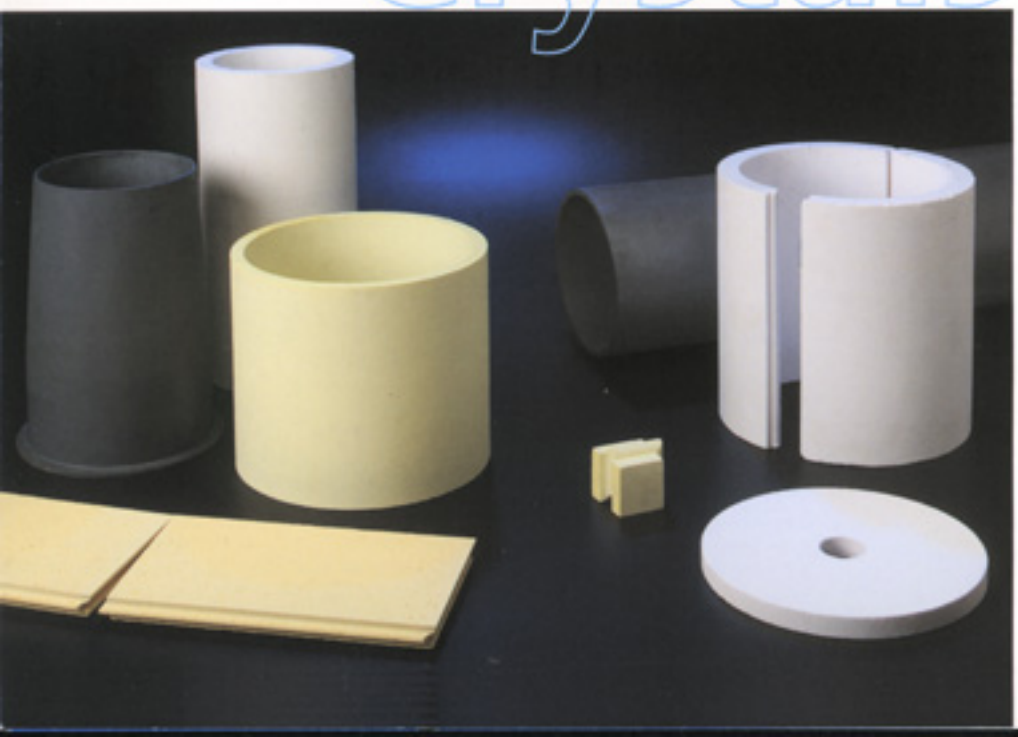
Substrates

Quartz & Crystals

High Performance Refractories for Quartz & Crystals

Saint-Gobain's zirconia and alumina refractories are proven to withstand extreme operating temperatures in quartz and crystal (ruby, sapphire, yttrium aluminum garnet, etc.) processing furnaces. Their low thermal conductivity is particularly valuable for minimizing heat loss and easily attaining maximum temperature.

Saint-Gobain is the leader in supplying silicon carbide process tubes used for lower-temperature crystal applications such as gallium arsenide and indium phosphide.



High purity zirconia and alumina products provide excellent stability and longevity in thermally demanding applications. Silicon carbide products provide outstanding strength and high thermal conductivity.

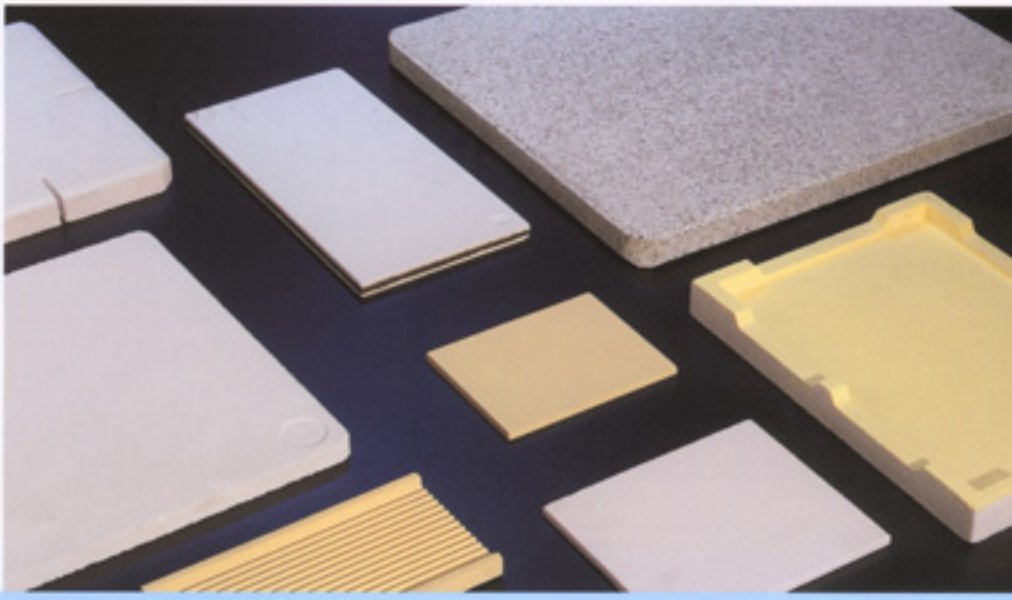
Ferrites

High Performance Refractories for Ferrites

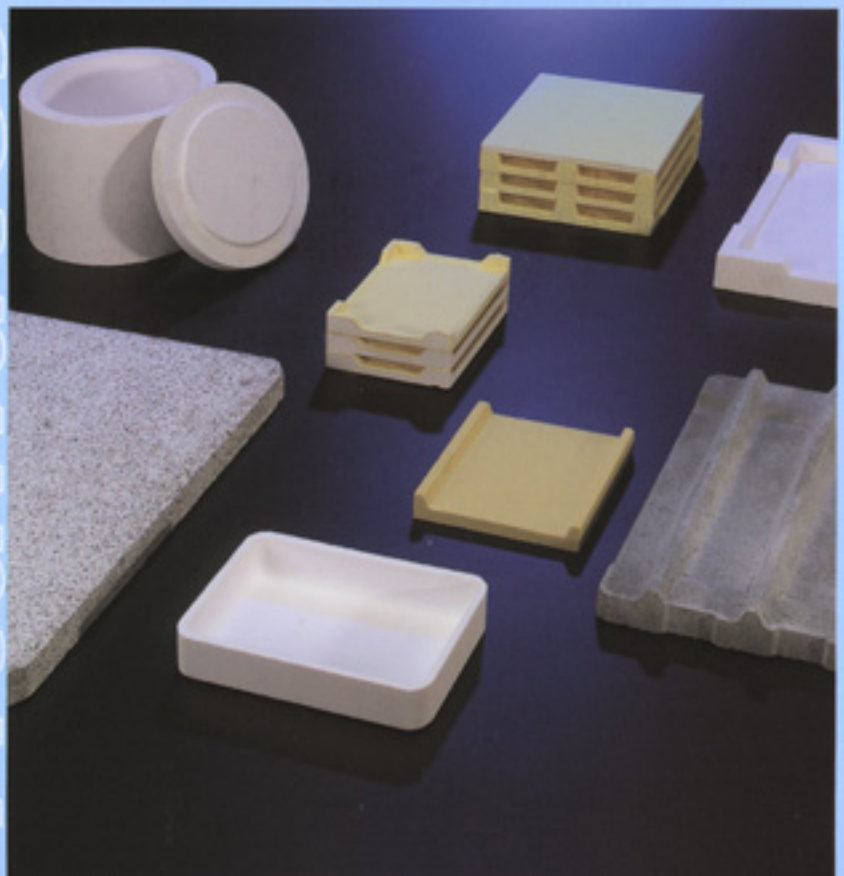
Thin, high strength alumina setters and "sandwich batts" are integral products used for firing soft ferrites (electromagnets). Saint-Gobain's refractories provide for lower mass and maximum productivity. Sandwich batts are manufactured with a core layer of silicon carbide sandwiched between two non-reactive surfaces of alumina. These batts provide improved thermal shock resistance and prolonged flatness retention.

Saint-Gobain's non-reactive zirconia refractories assist in achieving the highest ferrite permeability values.

High purity alumina, zirconia and zirconia-coated alumina products provide excellent strength, thermal shock resistance and low mass.



Titanates



High Performance Refractories for Titanates

Saint-Gobain's refractories are chemically compatible with titanate materials used to manufacture a variety of products including capacitors, RF filters, resistors, thermistors and piezo-electrics. Saint-Gobain's solid zirconia refractories are compatible with the most reactive titanate materials.

Zirconia-coated alumina refractories are also chemically compatible with titanate materials and result in less mass and longer life. All refractories are formulated for exceptional thermal shock resistance and high strength at temperature.

High purity alumina, zirconia, and zirconia-coated alumina products provide excellent strength and low mass along with non-reactive setting surfaces.

Saint-Gobain offers a diverse family of recognized refractory materials and products that are respected throughout the electronic ceramics market.

ALUNDUM® and ALFRAX® are high purity alumina compositions (85 to 99.8 percent). They are formulated for applications requiring high strength, thermal shock resistance, chemical compatibility/stability and are available in both dense and insulating (bubble grain) forms.

MULNORITE® and MULLFRAX® are fused mullite compositions formulated for a wide variety of applications requiring chemical and/or mechanical stability at elevated temperatures.

ZIRNORITE® Zirconia Refractories are calcia stabilized compositions available in both dense and insulating (bubble grain) forms. They are formulated for applications requiring chemical compatibility and/or mechanical stability at extreme temperature. The yttria stabilized composition is available in dense form only.

COATINGS are available in alumina, mullite, and zirconia applications requiring chemical compatibility.

OTHER REFRACTORY MATERIALS from Saint-Gobain include CRYSTOLON®, CRYSTON®, CARBOFRAX®, REFRAX®, SILIT® SK, and HEXOLOY®.

OTHER SAINT-GOBAIN PRODUCTS include a complete line of kiln component products comprised of bricks, hearth plates, muffles, support beams, and rollers for roller hearth furnaces.

YOUR SAINT-GOBAIN APPLICATION ENGINEER can specify recommended application compositions and answer your questions. Contact your application engineer directly or call 508-795-5577.

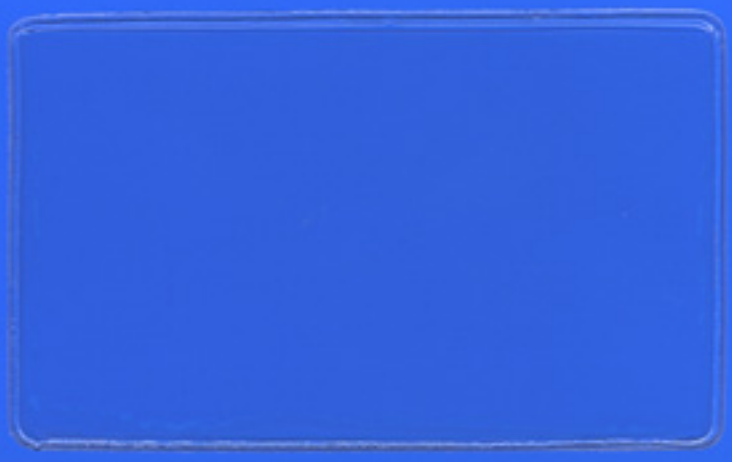


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Photo of BME MLCC Pusher Furnace Courtesy of BTU International