

Accelerator Components

FRIALIT®-DEGUSSIT® Oxide Ceramics



Created for High Performance

FRIALIT®-DEGUSSIT® Oxide Ceramics



Metalized Oxide Ceramics is the solution for numerous and demanding physical-technical applications. This makes FRIALIT®-DEGUSSIT® Oxide Ceramics equally indispensable in the field of medical technology as it is in research and development.

Meeting all requirements

Physical-technical applications place exceptional demands on the materials used: demands that often push metal, glass and plastics to their limits. This is where FRIALIT-DEGUSSIT Oxide Ceramics comes into play. It is extremely resistant to heat, corrosion and chemical influences while fully retaining its shape stability and resistance to wear-and-tear. Our components made of high-performance ceramic components retain their full functionality, regardless of the demands placed upon them.

Indispensable in Research and Development

Thanks to its unbeatable properties FRIALIT-DEGUSSIT Oxide Ceramics has become a must in virtually all fields of technology. Our ceramic-to-metal components are implemented especially in the field of electrical and medical technology and are vital components for accelerators and particle sources. Renowned institutes throughout the world rely on our high-performance materials. Special ceramic components with individual design and state-of-the-art technology are the answer to the problems of researchers and developers.

150 years experience

We provide you with the benefit of around 150 years of experience in the manufacture of ceramics, combined with comprehensive expertise in the field of ceramic-to-metal compounds. For each specific set of requirements our experts develop together with the customer an optimum solution based on high-performance materials. This results in ceramic-to-metal components that meet the very highest expectations.

Precise Diagnosis and Optimum Treatment

FRIALIT®-DEGUSSIT® Oxide Ceramics in Medical Technology



In both X-ray technology and oncological radiation therapy: Ceramic-to-metal components made of FRIALIT®-DEGUSSIT® Oxide Ceramics enable clear diagnoses with minimum radiation exposure.

The X-ray tube lies at the very heart of computerised tomography. It enables doctors to reach a precise diagnosis while keeping patient radiation exposure to a minimum.

The key components indispensable for modern X-ray diagnostics are the X-ray tube and X-ray image intensifier – components made of FRIALIT- DEGUSSIT Oxide Ceramics.

Our oxide ceramic products are the result of decades of experience combined with intensive research and

development and customer-focused product implementation. The X-ray image intensifier made by FRIATEC is an outstanding example of successful and sustainable cooperation with our customers. Tried and tested over many years, the product has been well-proven in practice and is now used in the field of radiology throughout the world.

The Heidelberg Ion-Beam Therapy Centre (HIT), designed as the first German institute for clinical radiation

therapy, and currently the only therapy unit for heavy ions in Europe, rely on our oxide ceramics.

Kicker chambers made of FRIALIT-DEGUSSIT Oxide Ceramics are fundamental components of the accelerator. They ensure optimum therapeutic results while at the same time minimizing the radiation dose for the patient.



1 The X-ray tube, the heart of computerised tomography. The use of oxide ceramics guarantees a long lifetime and high thermal resistance, thus making CT scanning a standard procedure for quick and reliable diagnostics.



2 The X-ray image intensifier for radiography enables precise diagnoses to be made while at the same time minimizing the radiation dose.



3 The kicker chamber of the particle accelerator ensures optimum therapeutic results with maximum conservation of healthy tissue.

High-Tech Materials for Particle Research

Accelerator Components made of FRIALIT®-DEGUSSIT® Oxide Ceramics



FRIALIT®-DEGUSSIT® Oxide Ceramics is the optimum material for demanding applications in fundamental physical research, particle physics and materials research. Its material properties meet the very highest demands – even under extreme conditions.

Vacuum chambers made of FRIALIT-DEGUSSIT Oxide Ceramics are used in accelerator units. In fast-pulsed bending magnets they also serve the purpose of injecting and extracting particles.

Demands on components made of oxide ceramics are extremely high during operation. High mechanical strength and loading capacity ensure reliability during operation. Components made of ceramic-to-metal compounds boast numerous

exceptional properties: They provide maximum electrical insulation, remain fully tight under extreme pressure or vacuum conditions, are exceptionally corrosion-resistant and even withstand temperatures exceeding 350 °C.

In contrast to metallic parts, ceramic components avoid the shielding of the rapidly changing external magnetic fields. Ceramic material is not heated by eddy currents. The additional coating on the inner surfaces of the ceramic

chambers, e.g. Ti or TiN, ensures the reliable discharge of image current and prevents secondary electron emission.

1 The kicker chamber made of FRIALIT-DEGUSSIT Oxide Ceramics is not heated by magnetic fields and ensures rapid and precise control of the beam.

Ø215 x L 400 mm

2 Vacuum chambers for particle accelerators made of FRIALIT-DEGUSSIT Oxide Ceramics: The Ti or TiN coating ensures reliable discharge of image current.

Ø150 x L 300 mm

3 In the high-voltage accelerator the particles are pre-accelerated directly after the ion / electron source and then led into the ring accelerator.

Ø350 x L 560 mm



Produced for:
RR CAT, Government of India



Produced for:
Budker Institute of Nuclear Physics



Produced for:
Budker Institute of Nuclear Physics

Preferred Partner in Science

Excellence in Technical Solutions



FRIATEC products are today used in scientific and technological institutes all over the world. Components made of FRIALIT®-DEGUSSIT® Oxide Ceramics are a major constituent of particle accelerators in renowned institutes.

In close cooperation with scientists, FRIATEC develops customized solutions of the highest technological standard. For this purpose FRIATEC carefully selects the best ceramic-to-metal compound for each application. A wide variety of compounds can be implemented either by traditional methods using metalized ceramics or by active welding.

A wide variety of magnetic and non-magnetic metals are here available. Due to their exceptional properties

and the individual approaches offered, accelerator units made of FRIALIT-DEGUSSIT Oxide Ceramics are the products of choice in renowned German institutes. These include the German Electron-Synchrotron Foundation (DESY) based in Hamburg and Zeuthen, the Jülich Research Centre (FZJ), the Helmholtz Centre for Heavy-Ion Research (GSI) in Darmstadt and the Karlsruhe Institute of Technology (KIT).

Also at international level many insti-

tutes rely on accelerator units made of FRIALIT-DEGUSSIT Oxide Ceramics: the Large Hadron Collider (LHC) at CERN, the European Organization for Nuclear Research in Switzerland, Cornell University, Ithaca, USA, and the Budker Institute of Nuclear Physics (BINP) at Nowosibirsk in Russia.

1 These high-voltage insulators for electron sources consist of layers of brazed ceramics and metal electrode rings with welded CF flanges.

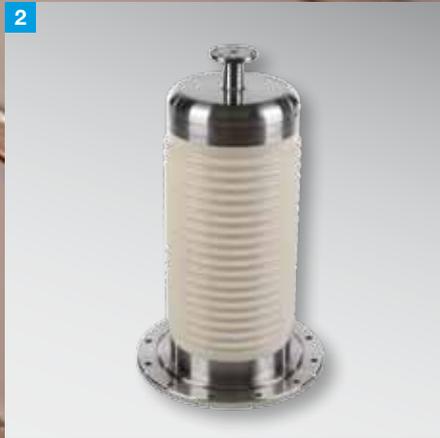
Ø560 x L 450 mm

2 In order to increase insulation the insulators and high-voltage feedthroughs are fitted with ribs. Glazing provides for a dirt-resistant surface.

Ø340 x L 585 mm

3 Individual vacuum chambers made of FRIALIT-DEGUSSIT Oxide Ceramics are produced in close cooperation with the customer.

Ø215 x L 400 mm



Produced for:
Cornell University



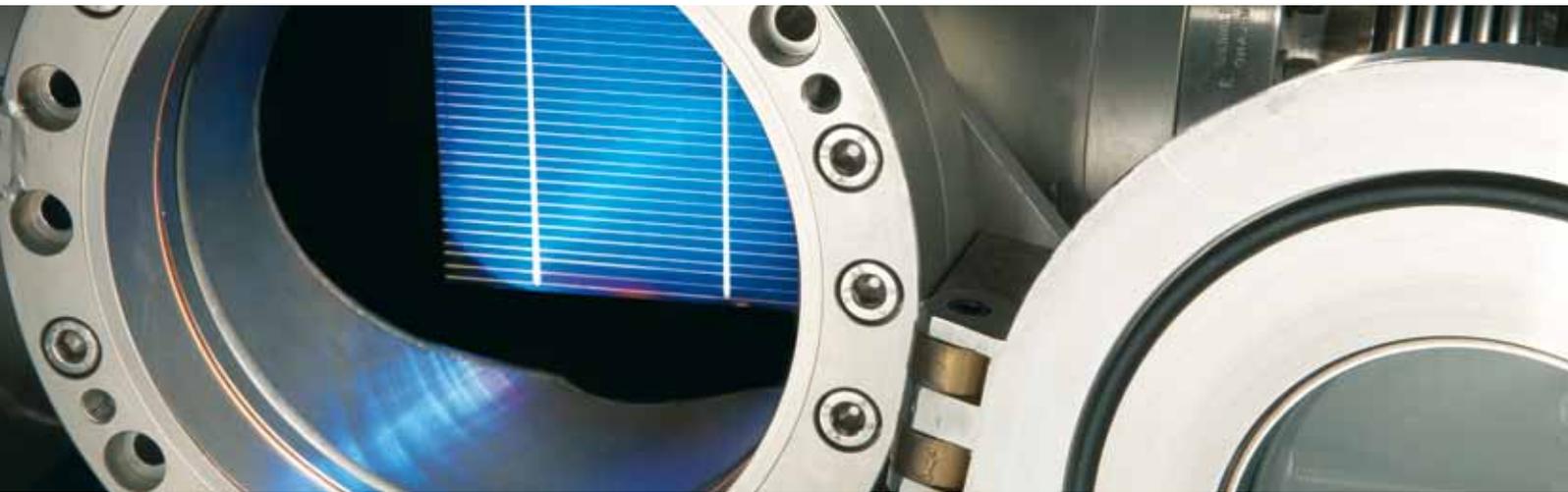
Produced for:
Joint Institute for Nuclear Research



Produced for:
RR CAT, Government of India

Precision Equipment for Research

FRIALIT®-DEGUSSIT® Oxide Ceramics in Vacuums



In Vacuum systems the outstanding properties of FRIALIT®-DEGUSSIT® Oxide Ceramics ensure precise and reproducible measurement results.

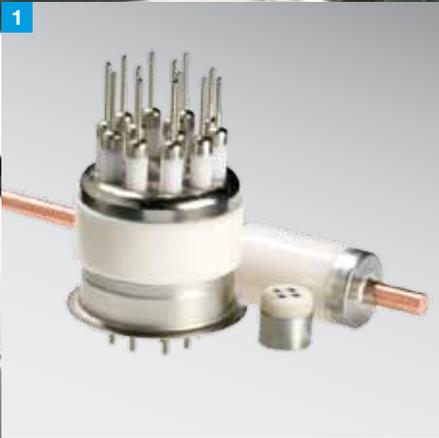
The ultra-high vacuum places new demands on conventional materials and joining techniques. Components made of FRIALIT-DEGUSSIT Oxide Ceramics are able to fully meet these challenges and show their strengths in the vacuum.

Minimum outgassing and leakage rates combined with optimum electrical insulation and thermal resistance guarantee an excellent level of reliability. Electrical feedthroughs made of ceramic-to-metal components allow transmission

of the smallest measurement signals between the vacuum chamber and the outside. Insulation tubes provide reliable separation of areas with different potentials. With crucibles made of FRIALIT-DEGUSSIT Oxide Ceramics materials can be reliably evaporated in the vacuum. Capillaries, tubes and insulating beads ensure perfect electrical insulation in vacuum chambers. Focusing units in electron microscopes require tolerances of just a few μm . Only this enables the

most varied products from research and technology to be examined at maximum resolution and depth of field. The lowest leakage and desorption rates are decisive for the functionality of the microscope.

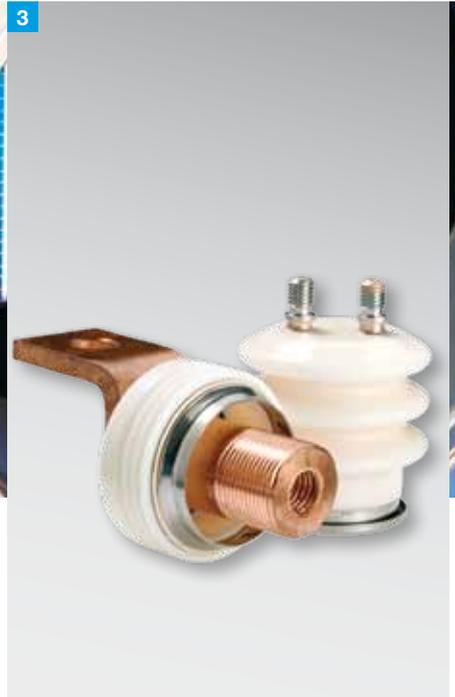
Due to their shape stability and outstanding electrical insulation properties, components made of FRIALIT-DEGUSSIT Oxide Ceramics guarantee excellent measurement results.



1 Single and multiple feedthroughs for ultra high-vacuum applications using FRIALIT-DEGUSSIT Oxide Ceramics ensure maximum electrical insulation with minimum outgassing and leakage rates.



2 FRIATEC insulation tubes provide maximum insulation and remain tight at extreme pressure and vacuum conditions and even resist temperatures exceeding 350 °C.



3 Whether high current, high voltage or measurement signals, FRIATEC manufactures tailor-made and standard components to customer specifications.

FRIATEC Aktiengesellschaft
Ceramics Division
Steinzeugstraße 50
68229 Mannheim
Phone: +49 621 486-0
accelerator@friatec.de
www.friatec.de

