



FERRO ELECTRONIC MATERIALS

Materials and
engineered products



WHY ENGAGE WITH FERRO ELECTRONIC MATERIALS?



- **We are one of the leading manufacturers** of materials and engineered products for devices in the electronic industry. Leveraging Ferro's Glass, Metal, Ceramics and Organic competencies, we provide our customers performance-enhancing engineered formulations.
- **Advancing technology through integrated material systems** which utilize our vertically integrated supply chain to create customized, proprietary products for our customers.
- **Worldwide technology resources** to provide our customers with hands on support to help customers design next generation electronics.
- **Responsible Environmental Care** through the offering of REACH and RoHS compliant products. Most of our glass and powder products are REACH registered.

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OUR ELECTRONIC PACKAGING MATERIALS

HYBRID INTEGRATED CIRCUITS (HIC)	2
HIGH TEMPERATURE CO-FIRED CERAMICS (HTCC)	3
LOW TEMPERATURE CO-FIRED CERAMICS (LTCC)	4
HEATER ON STEEL (HOS)	5

OUR ELECTRONIC COMPONENT MATERIALS

MULTILAYER CERAMIC CAPACITOR PASTES	6
COMPONENT MATERIAL PASTES	7
CERAMIC POWDERS AND FORMULATIONS FOR PASSIVE COMPONENTS	8

OUR ELECTRONIC GLASS MATERIALS

GLASS PASTES	9
ELECTRONIC AND TECHNICAL GLASS POWDERS	10

OUR ELECTRONIC AND TECHNICAL METAL POWDERS

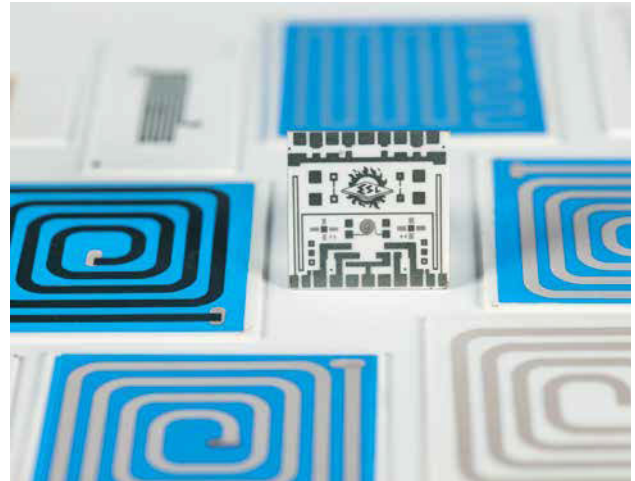
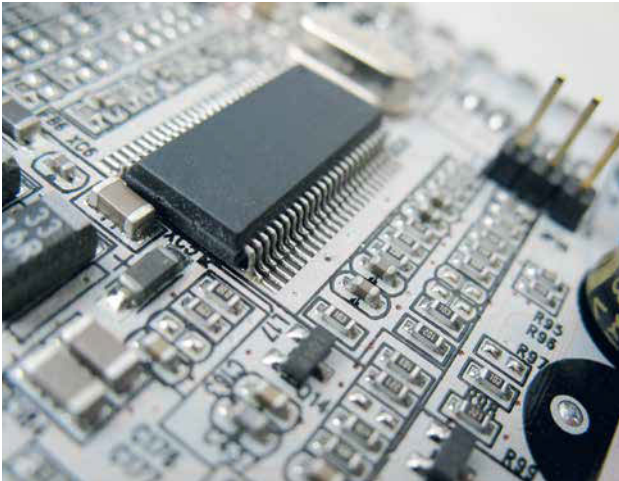
PRECIOUS METAL POWDERS, FLAKES AND PASTES	11
FUNCTIONAL SPECIALTIES	12

OUR ELECTRONIC PACKAGING MATERIALS

HYBRID INTEGRATED CIRCUITS (HIC)

Many applications in the telecommunications, automotive, medical, consumer and industrial markets operate under harsh conditions. Ferro Thick Film Pastes provide the ideal solution: Our products deliver high performance and meet the most stringent requirements for high reliability circuits under extreme operating conditions. We offer matched systems for single and multilayer packaging materials.

- **Dielectric Pastes**
Multilayer, Singlelayer, Capacitors
- **Conductor Pastes**
Gold, Silver, Alloys
- **Resistor Pastes**
Fixed Resistors, Thermistors
- **Overglaze Pastes**
Laser Trimable glasses, Polymer overcoats



HIGH TEMPERATURE CO-FIRED CERAMICS (HTCC)

Ferro Electronic Materials offers a comprehensive product portfolio for high temperature co-fired ceramics. We supply our customers with a broad range of products. Our HTCC tapes are based on Alumina and Zirconia and our HTCC pastes are based on platinum and zirconia. Our materials are used for applications such as oxygen sensors, temperature sensors, particle sensors, NOx sensors and imbedded heaters.

- **HTCC Tapes**
Alumina, Zirconia
- **HTCC Pastes**
Platinum, Zirconia



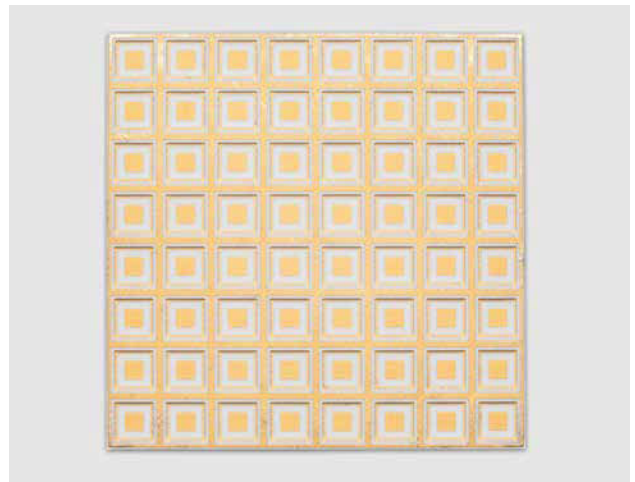
OUR ELECTRONIC PACKAGING MATERIALS

LOW TEMPERATURE CO-FIRED CERAMICS (LTCC)

Ferro Electronic Materials for more than 20 years has provided high reliability LTCC products for high frequency. We offer lead-free high frequency glass-ceramic formulations for use, up to 240 GHz, with state of the art low insertion loss and provide many material options for conductor and LTCC systems. Our product portfolio includes glass-ceramic composite formulations for modules, packages, substrates, and complex LTCC chip components; all with stable K and low dissipation over 40 GHz.

We are the performance leader in radar, antenna, electronic filter, satellite and telecom applications. Where high frequency, low loss, package volume and weight are important we can offer customers the best possible solution.

- **LTCC Tapes**
 - L8
 - A6M-E
- **LTCC Conductor Pastes**
 - Gold Systems
 - Silver Systems
 - Mixed Metal Systems



HEATER ON STEEL (HOS)

Ferro Electronic Materials is known for its premium paste systems for HOS products which require robust and rigid substrates. Customers use our pastes either on stainless or on austenitic steel. We ensure that our systems are proven and synchronized, allow a wide range of resistors, direct energy transfer and a high power density in conjunction with small size. Our solutions meet perfectly the requirements in applications within appliances and consumer goods, as well as industrial products.

- **HOS Dielectric & Overglaze Pastes**
- **HOS Conductor Pastes**
- **HOS Resistor Pastes**

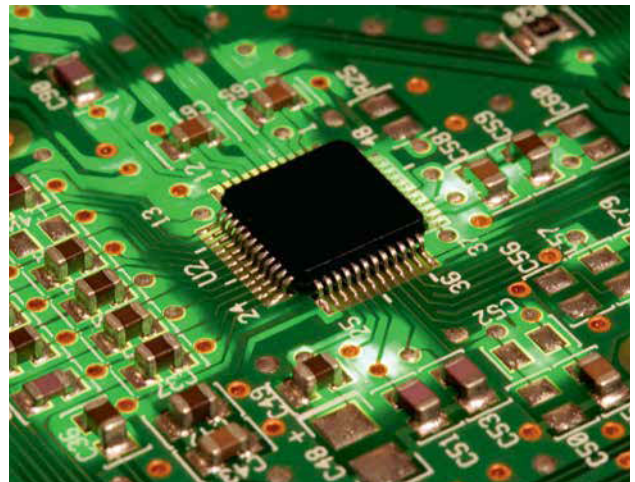


OUR ELECTRONIC COMPONENT MATERIALS

MULTILAYER CERAMIC CAPACITOR PASTES

Ferro Electronic Material offers a broad selection of conductor pastes suitable for many applications in multilayer and chip components. Ferro's in-house metal and glass formulation and R&D enable us to tailor products to meet specific needs, including working closely with customers to develop the optimum application methods such as dipping, drying or firing.

- **AgPd Inner Electrode Paste**
- **Precious Metal Pastes for Terminations**
- **Base Metal Pastes for Terminations**



COMPONENT MATERIAL PASTES

Ferro Electronic Materials offers pastes that are designed for non-MLCC devices such as inductors, filters, thermistors and actuators. The paste property can be optimized by Ferro's in-house glass and metal expertise.

- **Silver Inner Electrode Paste for Chip Inductors**
- **Component Overglaze Paste**
- **Thermistor Pastes**
- **Pastes for VDR discs**
- **Pastes for Piezoelectronic Ceramics**



OUR ELECTRONIC COMPONENT MATERIALS

CERAMIC POWDERS AND FORMULATIONS FOR PASSIVE COMPONENTS

Ferro Electronic Materials supplies a wide range of materials for passive chip component applications including Formulated Dielectrics, Solid State Barium Titanates and an assortment of Functional Oxide, Titanate, Stannate and Zirconate Powders. We are the preferred source for many electronic ceramic formulators who use our products in the manufacture of dielectric products for single & multilayer ceramic capacitors, piezoelectronics, embedded capacitors, filters, thick film devices, composite polymer films and a multitude of other applications.



- **Dielectric Formulations for Ceramic capacitors**
 - X7R/X8R Type Dielectrics
 - COG Type Dielectrics
 - High Frequency Dielectrics
- **Barium Titanate and Functional Additive Powders**
- **Low Temperature Ceramics for Non-Capacitor Components**
 - Low Temperature Glass Ceramic Composite
 - Low Temperature Ceramic Formulations
- **Binders for tape casting**
- **Modifiers**
 - Dispersents
 - Viscosity Adjuster
 - Plasticizers

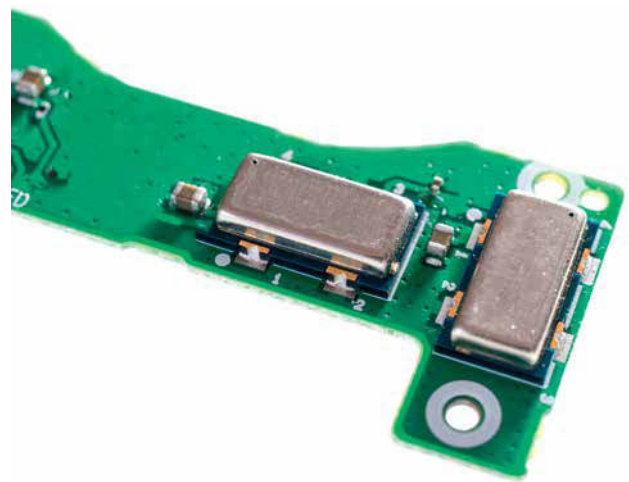


OUR ELECTRONIC GLASS MATERIALS

GLASS PASTES

Ferro Electronic Materials offers Thick-Film sealing glass pastes which find use in end applications including sealing paste for packages of ceramic, glass or metal materials or for automotive sensors.

- **Sealing Glass Pastes for MEMS and Micro Mechanical Devices**
 - Accelerometers
 - Yaw-Gyro
 - Vibration
- **Technical Sealing Glass Pastes**
 - For Packages (Ceramic, Glass, Metal)
 - For Automotive Sensors (Fuel-, Oxygen sensors, SOFC)



OUR ELECTRONIC GLASS MATERIALS

ELECTRONIC AND TECHNICAL GLASS POWDERS

Ferro Electronic Materials offers a comprehensive product portfolio of glass and glass-based powder products for component and engineered material manufacturers within the electronic and high technology industries. Our customers can choose among a wide range of compositions and powder types.

- **Technical Glasses**

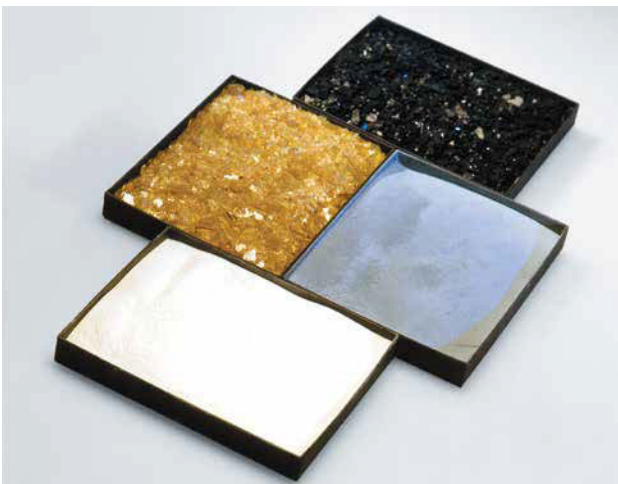
- For use as protective and insulating layers, binding agents in metal or ceramic formulations, and sealants for a variety of ceramic, metal and glass components.

- **Low Temperature Pb-based Glasses**

- **Low Temperature Pb-free Glass Powders**

- **Passivation Glasses**

- Glasses for hermetic on-wafer passivation and encapsulation of Si devices

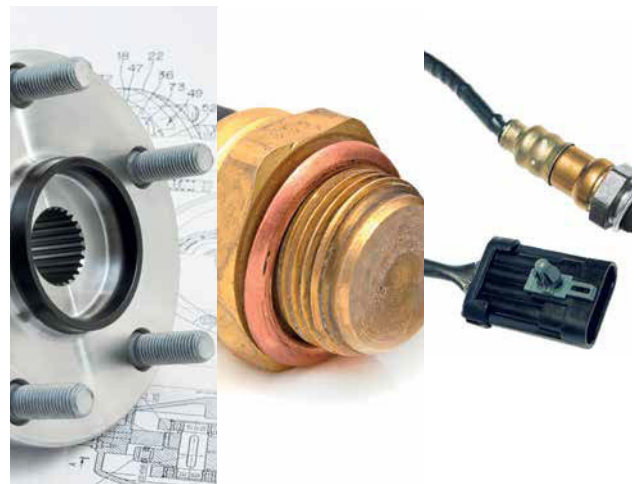


OUR ELECTRONIC AND TECHNICAL METAL POWDERS

PRECIOUS METAL POWDERS, FLAKES AND PASTES

With our large product portfolio we meet the individual needs of customers in the sensor industry. Ferro Electronic Materials offers powders and pastes of gold, platinum, palladium and rhodium. Customers can rely on our 45 years' experience with precious metals, our expertise in analytics and application technology and our particle know-how for precious metals. Our in-house manufacturing starting with raw materials and intermediates enables individual and highly flexible solutions meeting exact customer needs.

- **Gold Powder & Flakes**
- **Platinum Powder & Flakes**
- **Palladium Powder & Flakes**
- **Rhodium Powder**
- **Platinum/Rhodium Powder**
- **Pastes based on all precious metals**



OUR ELECTRONIC AND TECHNICAL METAL POWDERS

FUNCTIONAL SPECIALTIES



Ferro's functional specialties portfolio offers innovative products for customers. Our Silver paste being used in the low temperature joining technology is the perfect joining solution e.g. for semiconductor devices like IGBT (insulated-gate bipolar transistor) chips. Due to high temperature resistance it is a superior technology compared to soldering. Final applications include wind-mills, high voltage, power LED and sensors. Also unique is Ferro's silver glue which ensures electrical conductivity of chips on credit cards within seconds thanks to fast curing without UV.

- **Low Temperature Sintering Silver Paste**
- **Conductive Glue**
- **Polymer Silver Conductive Pastes**

Americas

USA

King of Prussia, PA

Ferro Corporation
416 East Church Road
King of Prussia, PA
19406-2625
P +1-610-272-8000
F +1-610-272-6759

USA

Penn Yan, NY

Ferro Corporation
1789 Transelco Drive
Penn Yann, NY
14527-9752
P +1-315-536-3357
F +1-315-536-8091

Europe

Germany

Frankfurt/Main

Ferro GmbH
Gutleutstraße 215
60327 Frankfurt
P +49-69-2711-6494
F +49-69-2711-6333

Germany

Hanau

Ferro GmbH
Rodenbacher Chaussee 4
63457 Hanau
P +49-61815-947-42
F +49-61815-930-71

Asia Pacific

China

Ferro Shanghai Co. Ltd
Room 709, Tower B,
Far East
International Plaza
No.317, Xianxia Road,
Changning
Shanghai 200051
P +86-213-335-2258
F +86-215-168-5198

Taiwan

Ferro Taiwan Ltd.
6F-3, No.408
Ruiguang Rd, Neihu Dist.
Teipei City, 114
P +886-2-2799-0886
F +886-2-2799-6169

Japan

Ferro Japan KK
Quest Marunouchi Bldg.
3-4-30, Marunouchi
Naka-ku, Nagoya-shi
P +81-52-962-8071
F +81-52-951-0865

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Safety&Handling

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Performance Colors & Glass

Ferro Corporation
Global Headquarters
6060 Parkland Boulevard
Mayfield Heights
Ohio 44124
USA

www.ferro.com

P +1 216 875 5600
F +1 216 875 5627