



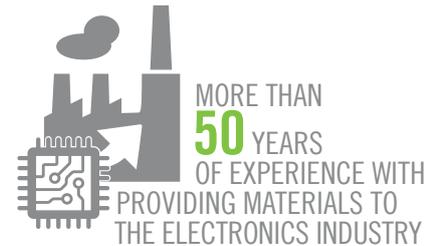
HERAEUS ELECTRONICS
YOUR MATERIALS SOLUTIONS PARTNER

WE ARE HERAEUS ELECTRONICS

HEADQUARTERED IN
HANAU, **GERMANY**

We are one of the leading suppliers of material solutions for Electronics Packaging and Component Industry in Power Electronics, Advanced Semiconductor Packaging and Automotive Electronics.

Our core competences include bonding wires, assembly materials, thick film pastes, substrates, and their integration into perfectly matched systems.





YOUR SUCCESS IN A COMPETITIVE AND FAST MOVING MARKET

In today's highly competitive and fast-paced markets, short lead time and development process are your key to remain competitive. Customer expectations on device features and tough price competition are ever increasing.

To succeed and be ahead of your competition, it is essential to optimize your design and processes, shorten your development cycles which in turn reduce costs, and also mitigate risks in all aspects. Our mission is to help you fulfill all requirements at maximum yield.

With a good combination of material expertise and technological know-how, our team can look into your processes and challenges, and develop high-quality solutions that strengthen your competitiveness.

We are your ideal partner to achieve your business objectives and guide your business to greater success.

YOUR ONE-STOP MATERIALS SOLUTIONS PARTNER

Electronic devices consist of many materials: substrates, connectors, active and passive components, solders, adhesives, bonding wires, insulation and molding compounds and housings. When these materials are combined in a single device, complexity increases. Different suppliers make it even more complex.

We dissolve these issues by creating perfectly matched solutions that minimize complexity and compromises. With our expertise, we provide you with innovative materials as well as sets or systems of matched materials.

We also support you with excellent engineering services. In order to verify the quality of our tailored solutions we offer extensive prototyping, testing and qualification.

It takes deep materials knowledge in combination with systems know-how, testing expertise and manufacturing process experience to solve technical challenges. Therefore, outsourcing of the material system design to Heraeus experts creates a double advantage. On the one hand you are getting a better, smaller, more reliable, environmentally-friendlier, easy-to-manufacture and integrate electronic component. On the other hand you are gaining the freedom to concentrate on other development tasks at the same time.



MANAGING YOUR CHALLENGES

Time to market is extremely important in the fast growing electronics market. With each new technology generation, electronic devices need to deliver higher performance and greater functions in a smaller form factor.

Development targets are to reduce device size and weight, improve reliability and heat dissipation, and also to ensure compliance with global environmental regulations. Heraeus is a reliable partner to overcome these challenges.



Shorter time to market

It is crucial to deliver new solutions fast and ideally be a first mover on the market. By partnering with Heraeus, we can support with our material expertise and shorten your time to market. We have the capability to match all materials in a perfectly matched system with optimized interfaces between the materials, enabling us to develop and deliver better solutions in shorter time.



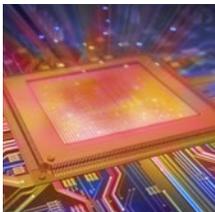
Demand for reliability

The operational life span of an electronic component should outlast the operating time of the device it is used in. Degradation mechanisms must be considered in the design of a component to make it as robust as possible against thermo-mechanical stress and harsh environmental conditions. It takes deep materials knowledge in combination with systems know-how, testing expertise and manufacturing process experience to simulate long-time operating spans.



Miniaturization and weight reduction

Demands on the performance and functionalities of consumer devices in a smaller space is ever increasing. Smaller components require less material, saves space and in most cases are lighter. It also saves costs, especially if precious metals are involved.



Thermal management

The heat caused by power losses needs to be dissipated. This requires efficient management of thermal energy, otherwise chips can be damaged and service lifetime lowered. Our matched materials systems offer unique advantages as our development team can work with the specification data of the whole system.



Legal compliance requirements

In order to improve environmental protection and sustainability, legislations such as RoHS, ELV, REACH and others have a growing influence on the design of technical solutions. It is important to substitute legislation critical materials, however, alternatives often do not offer the same absolute performance. A broad spectrum of materials knowledge is required to develop solutions with a similar outcome, good manufacturability and full compliance with the law.

OUR MATERIALS

From stand-alone materials to matched materials solutions, we support applications in markets like automotive, consumer electronics, communications, LED, and power electronics.

Our core competencies include bonding wires, adhesives, solder materials, sinter materials, thick film pastes, metal substrates, and metal ceramic substrates.

THICK FILM MATERIALS

Small design spaces, harsh conditions and requirements for reliable circuits are the challenges of many industries including the automotive sector, medical devices, aerospace, telecommunications, and consumer electronics. Heraeus Thick Film Materials provide the solutions needed across these broad application ranges.

- Hybrid Pastes
- Passive Component Pastes
- Paste for Fuel Senders
- Thick Printed Copper
- Sensor Pastes
- LTCC Materials
- Pastes on Steel

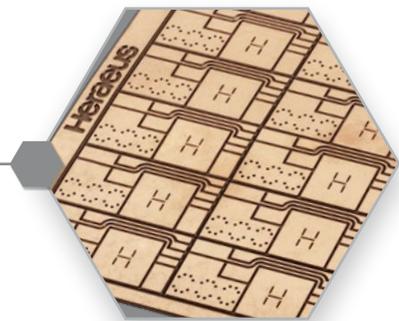


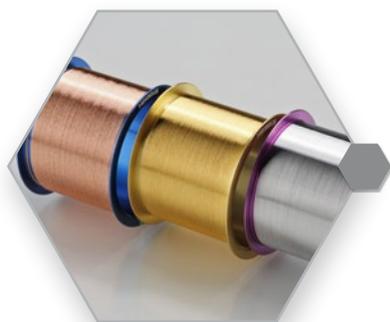
METAL CERAMIC SUBSTRATES - Condura®

Comprehensive portfolio of metal ceramic substrates to optimally address the diverse requirements of the power electronic industry from low-power applications up to the most demanding ones.

- **Condura®.classic**
DCB- Al_2O_3 substrates (direct copper bonded alumina)
- **Condura®.extra**
DCB-ZTA substrates (zirconia toughened alumina)
- **Condura®.prime**
AMB- Si_3N_4 substrates (active metal brazed silicon nitride)
- **Condura®.ultra**
 Si_3N_4 Ag-free AMB substrates
- **Condura®+**
Choose your PROPERTY PLUS

- DCB- Al_2O_3
- DCB-ZTA
- AMB- Si_3N_4
- Si_3N_4
- PLUS





BONDING WIRES

Heraeus offers a portfolio of bonding wires with materials ranging from gold to copper, exactly fitting to your different applications and requirements. For the selection of the ideal solution, our specialists with years of experience support you with their technical expertise and application know-how.

Gold and Silver Bonding Wires | Fine Bonding Wires | Special Wires

Aluminum Fine and Thick Bonding Wires and Ribbons

Copper, Copper Thick and Coated Copper Bonding Wires



ADHESIVES

Heraeus offers conductive and non-conductive adhesives for electronic component mounting applications. The materials are matched to the common processes used to mount components with excellent printing and dispensing properties. Our solutions simplify manufacturing processes and increase efficiency.

Conductive Adhesives | Non-Conductive Adhesives | SMT Adhesives



SOLDER MATERIALS

Heraeus specializes in the manufacturing of interconnected solder materials with products ranging from solder powders to wires, for die attach and SiP applications in semiconductors, advanced packaging, SMT, and other components of the electronics industry. Our solutions meet the highest standards in quality and process stability; ensuring superior reliability.

Solder Pastes | Solder Wires for Die Attach | Solder Powder | Solder Fluxes



SINTER MATERIALS

Heraeus mAgic series of silver sintered pastes offers a robust lead-free and halogen-free die-attach alternative where high reliability is vital. Designed for applications which demand excellent electrical and thermal conductivity, mAgic is an attractive solution, especially for power electronics.

mAgic® Sinter Pastes

OUR MATERIALS SOLUTIONS

Due to continuous rise in power density, coupled with higher operating temperatures and demand for improved reliability, packaging materials are brought to their limits. Material improvement in one single layer would only lead to a small contribution and shift the weakest point to the

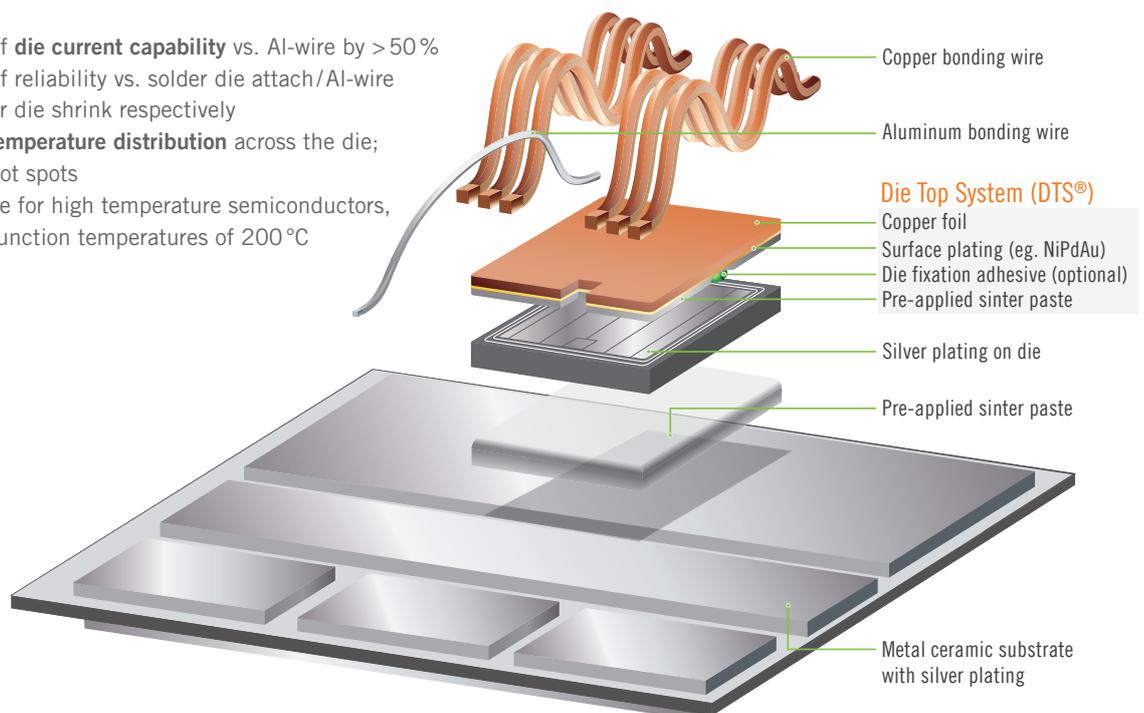
next joining layer. It is necessary to work on solutions which take into account the whole stack of materials in the power module to enable significant performance improvement.

DIE TOP SYSTEM[®] Get the most out of your power module

The new Heraeus Die Top System (DTS[®]) enables use of copper wire in combination with sinter technology. It enables easy processing and significantly improves the electrical, thermal and reliability performance of the die connection, and improves the whole module performance.

Benefits:

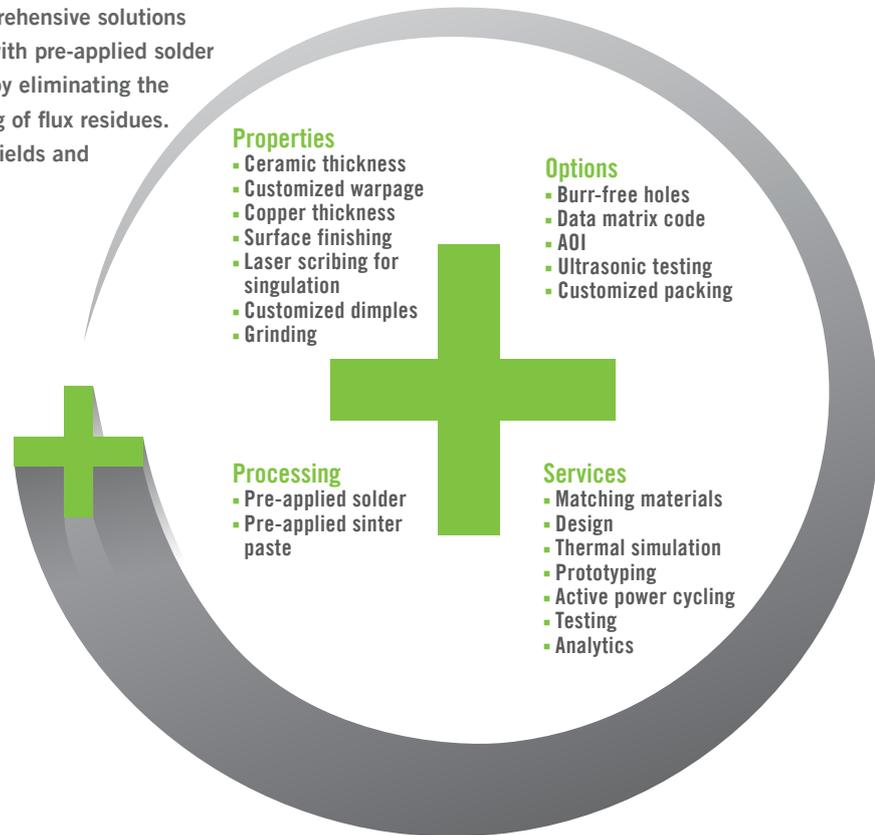
- Increase of **die current capability** vs. Al-wire by >50%
- Increase of reliability vs. solder die attach/Al-wire of >10x or die shrink respectively
- **Uniform temperature distribution** across the die; avoiding hot spots
- Compatible for high temperature semiconductors, enabling junction temperatures of 200 °C



Condura[®]+

Choose your plus

Heraeus Condura[®]+ offers a comprehensive solutions portfolio: for example, Condura[®] with pre-applied solder reduces complexity in production by eliminating the step of printing solder and cleaning of flux residues. At the same time it increases the yields and enables cost savings.



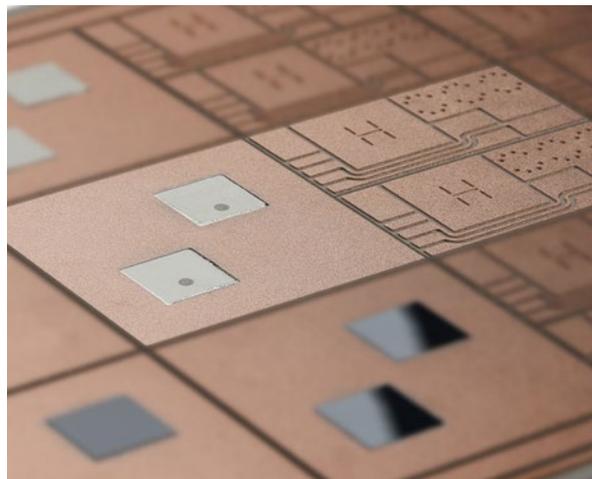
Condura[®] with pre-applied solder

Direct copper bonded alumina substrates with pre-applied flux-free solder pads for die attachment.

Thanks to the innovative die fixation dot, the soldering process is significantly simplified.

Benefits:

- 50% less soldering process steps
- No cleaning steps required
- Lower investment
- No solder or flux splatters
- Improved yield
- Lower production risks
- No need for solder-stop



LET OUR SERVICES BECOME YOUR STRENGTH

Our state-of-the-art application center offers a range of services to develop customer solutions in Hanau, near Frankfurt (Germany). Over 25 developers enable fast development and an efficient use of resources in the value chain. The application center offers an infrastructure for simulation, design, prototyping, testing and qualification of material systems in power electronic modules on 730 m², thereof 110 m² ISO8 clean room.

Our regional service labs in West Conshohocken (USA), Shanghai and Changshu (China) and Singapore are specialized in the needs of the local markets and guarantee a close proximity and quick response time for our customers.

Our R&D and services work in close cooperation with customers, universities, and research institutes.



Our service offer includes:

- Processing support
- Optimization of process parameters
- Electrical and mechanical design of power modules
- Prototyping of subassemblies and complete modules
- Destructive and non-destructive material testing
- Active and passive reliability tests
- Environmental tests
- Metallography and microscopy
- Thermal, thermo-mechanical and lifetime simulation

By using our comprehensive state-of-the-art equipment and tools the customers benefit from faster development with higher first-time success rates. Our service portfolio together with our experience in packaging solutions contribute to customer's problem solving.



OUR WORLDWIDE LOCATIONS

Close to your development centers and factories we have experts located in Asia, US and Europe to grant fast reaction and easy access without language barriers.

Being ISO/TS 16949, ISO9001, and ISO 14001 certified allows Heraeus to offer an even higher level of service and it is our conviction to develop environmentally friendly products that meets RoHS, ELV and REACH compliance regulations.



PRODUCTION SITES

Hanau | Timisoara | West Conshohocken | Johor Bahru | Changshu | Shanghai | Zhaoyuan | Singapore



APPLICATION CENTERS

Hanau, | West Conshohocken | Changshu | Shanghai | Hsinchu | Singapore

HERAEUS GROUP THE GLOBAL TECHNOLOGY COMPANY

Heraeus, the technology group headquartered in Hanau, Germany, is a leading international family-owned portfolio company. The company's roots go back to a family pharmacy started in 1660. Today, the Heraeus group includes businesses in the environmental, electronics, health and industrial applications sectors. Customers benefit from innovative technologies and solutions based on broad materials expertise and technological leadership.

In the 2020 financial year, the FORTUNE Global 500 listed group generated revenues of €31.5 billion with approximately 14,800 employees in 40 countries. Heraeus is one of the top 10 family-owned companies in Germany and holds a leading position in its global markets.

The data given here is valid. We reserve the right to make technical alterations.

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The descriptions and engineering data shown here have been compiled by Heraeus using commonly-accepted procedures, in conjunction with modern testing equipment, and have been compiled as according to the latest factual knowledge in our possession. The information was up-to date on the date this document was printed (latest versions can always be supplied upon request). Although the data is considered accurate, we cannot guarantee accuracy, the results obtained from its use, or any patent infringement resulting from its use (unless this is contractually and explicitly agreed in writing, in advance). The data is supplied on the condition that the user shall conduct tests to determine materials suitability for particular application. The Heraeus logo, Heraeus, Condura®, DTS®, Die Top System® and the Condura, DTS, Die Top System figurative mark are trademarks or registered trademarks of Heraeus Holding GmbH or its affiliates. All rights reserved.

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