

Assembly Solutions for Battery Modules

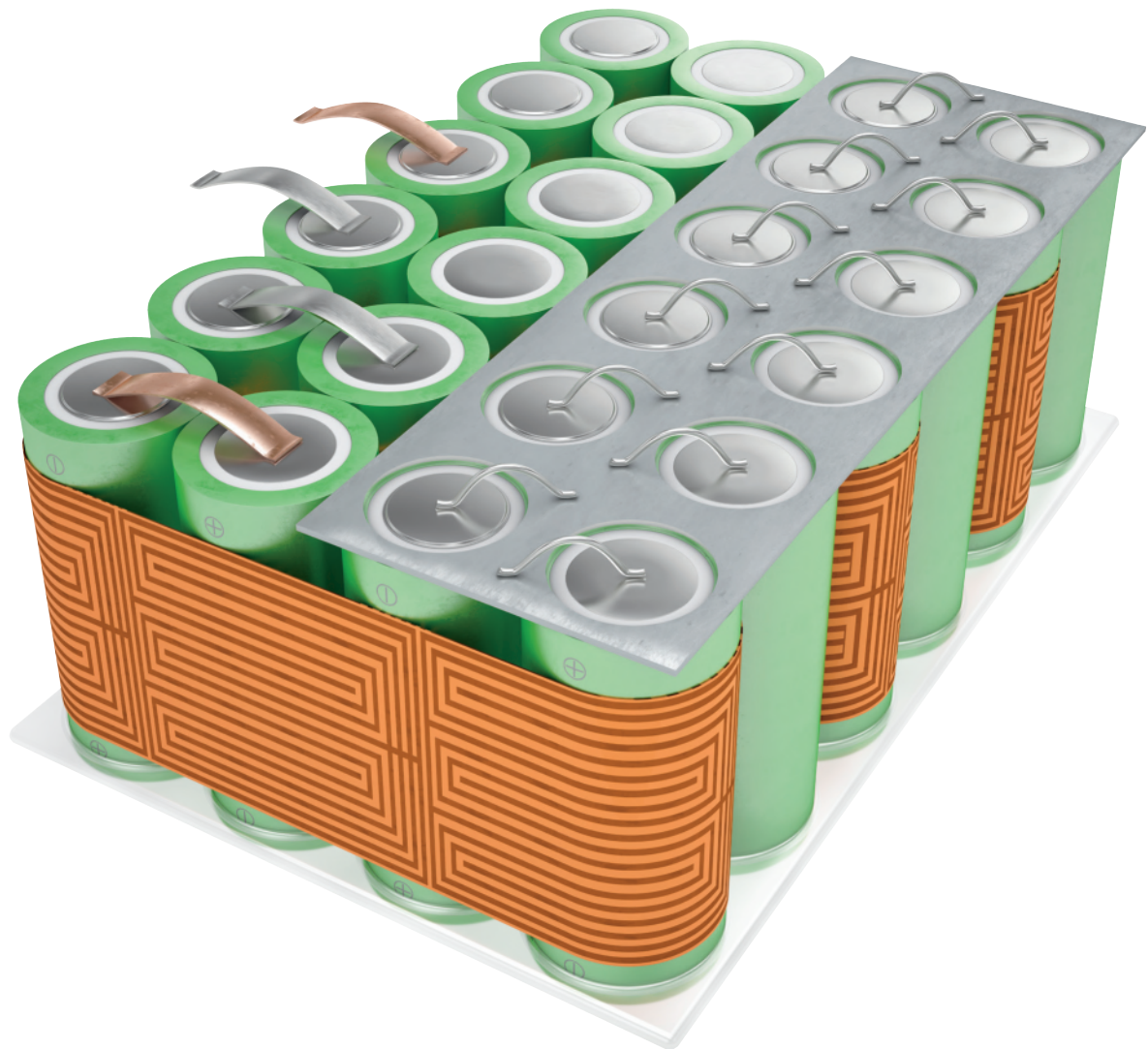
The Future of Battery Industry

In recent years, the battery industry has changed dramatically and continues to see growth at a rapid pace. Trends such as hybrid and pure electric vehicles are changing the market outlook of the global battery industry and require highly reliable materials solutions that are energy and cost efficient.

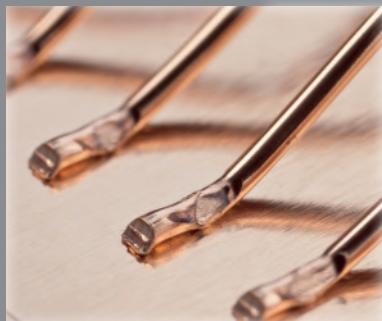
Heraeus has been a global leader in innovation for **over 160 years** and at Heraeus Electronics, we recognize the fast paced environment and the demand in the battery industry.

With **Heraeus assembly solutions** we look to give our customers the competitive advantages to move with the pace of the industry, and the technical know-how to advance their designs.

Heraeus assembly solutions for battery modules offer a wide range of battery cell connections and heaters that provide customers with the latest technology for reliable bonds, design flexibility, and optimal performance that will **power your business** into the future of battery technology.



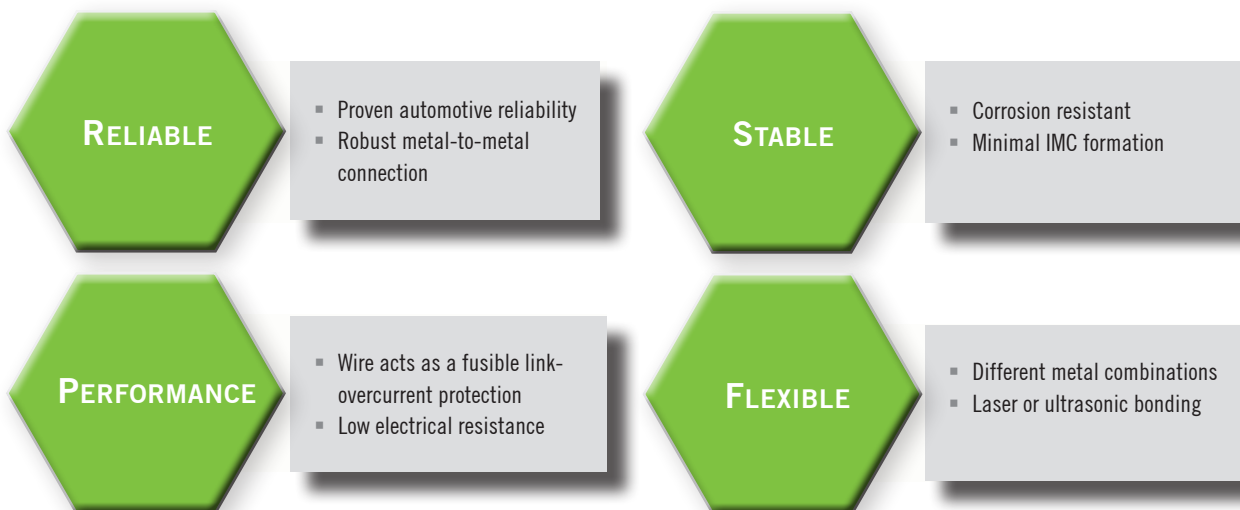
The Complete Range of Battery Cell Connections



With ever-increasing requirements on the reliability of battery modules, wire bonding technology is being utilized to further improve and overcome drawbacks associated with soldering and welding. At Heraeus, we offer a full range of high-purity products

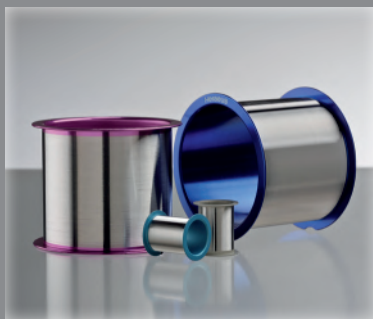
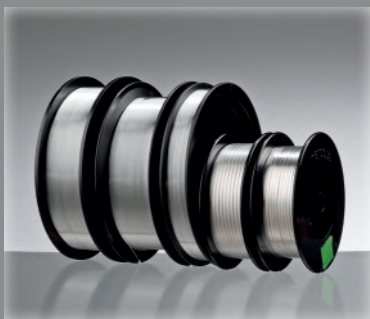
ranging from aluminum wires for low currents to ribbons with large cross-sections for high power transmission. All of them boast high reliability, excellent performance, and outstanding workability for a wide range of processing approaches and applications.

Advantages of Bonding Wires and Ribbons



Wire and Ribbon Technology in Battery Module and Pack Assembly

	Module Assembly		Pack Assembly		Power Modules
Connection	Cylindric cell-to-cell	ECU-to-busbar	Prismatic larger cells	Cells package to outside	Power management
Wirebond Method	Aluminum ultrasonic wire bonding wedge/wedge	Aluminum ultrasonic wire bonding wedge/wedge	Laser or ultrasonic bonding	Laser bonding	Power module fabrication
Advantage	High level of automation, fast, no heat impact to cell	High level of automation, fast, no heat impact to cell	Limited heat impact to cell	Limited heat impact to cell	Well known electronic module performance
Bonding Material	Al wire, Al ribbon	Al wire, Al ribbon	Cu ribbon or Al ribbon	Cu ribbon or Al ribbon	Al wire, Al ribbon

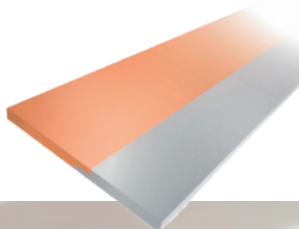


Heraeus Bonding Wires and Ribbons for Battery Technology

	Wire Type						Ribbon Type			
	<i>AluBond</i>		<i>CucorAl</i>		<i>PowerCuSOFT</i>		<i>AluBond</i>		<i>PowerCuSOFT</i> *	
Description	Aluminum > 99.99% Corrosion Resistant		CuCorAl Type		PowerCuSoft Copper > 99.99%		Aluminum > 99.99% Corrosion Resistant		PowerCuSoft Copper > 99.99%	
Function	Bondable Aluminum		Copper core / Al bond mantle		Soft bondable copper		Bondable Aluminum		Soft bondable copper	
Typical Dimensions	μm	mil	μm	mil	μm	mil	μm	mil	μm	mil
	200	8	200	8	200	8	1.00 x 0.10	40 x 4	1.00 x 0.10	40 x 4
	300	12	300	12	300	12	1.50 x 0.20	60 x 8	1.50 x 0.20	60 x 8
	375	15	375	15	375	15	2.00 x 0.20	80 x 8	2.00 x 0.20	80 x 8
	400	16	400	16	400	16	2.00 x 0.30	80 x 12	2.00 x 0.30	80 x 12
	500	20	500	20	500	20	2.00 x 0.40	80 x 16	2.00 x 0.40	80 x 16

* Under development

B-Con Roll Clad Copper/ Aluminum Strips



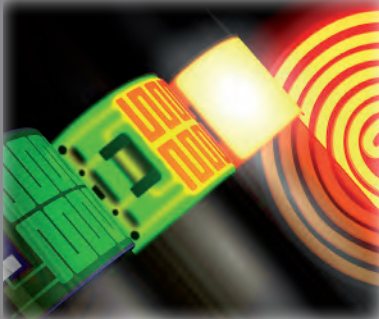
B-Con™ is a roll clad strip consisting of Cu and Al – materials which are not weldable. Both materials are connected firmly bonded and show a low electrical

resistance and a low weight. B-Con™ can be used as cell connector for Li-Ion batteries for hybrid and electric vehicles.



Form of Delivery	Semi-finished Strip
Strip thickness [mm]	0.2 - 1.5
Strip width [mm]	25 - 150
Overlap zone [mm]	7.5 - 15
Coating (incl. overlap zone)	Electroplated Ni and Sn
Materials	Copper & Copper Alloys Aluminum & Aluminum Alloys

Heaters for Battery Applications



Thick film heater materials provide precision elements ideal for space-limited form factors and extremely fast response times, up to 150°C/sec. With operating temperatures from below zero through 1000°C,

thick film technology provides heating elements with outstanding environmental and chemical stability for extended product lifetimes and lower cost of ownership.

Advantages of Thick Film Technology

DESIGN

Form Factors & Design Flexibility

Space limitations, miniaturization, thin substrates, large or small areas, planar or cylindrical surfaces

Precision & Uniformity

Heating exactly where needed, temperature zone optimization, temperature stability

PERFORMANCE

Fast Response Times

Low thermal mass, high conductivity

Power Handling

High watt density

High Reliability

Thermal cycling
Thermal shock
Humidity & Environment stability
Chemical stability

MATERIALS & SYSTEMS

Matched Materials Packages per Substrate

Conductor, Resistor, Insulator Pastes

Operating Temperatures

Up to 1000°C

Substrates

PET, PEN, PI, FR4, PI, Aluminum, Steel, Al₂O₃, YSZ, ZrO, AlN

Heater Systems by Substrates Type

Substrates	PET, PEN	FR4, Polyimide	Aluminum (Celcion)	Stainless Steel (HeraMic)	
Operating Temperature	Up to 100 °C	Up to 250 °C	Up to 200 °C	Up to 350 °C	
Conductor	LTC3602 LTC3501	LTC3301 LTC3501	C8829D	SC1001	
Resistor	LTR4905 LTR4911 LTR4600 Series	LTR4300H Series PTC Self Regulating (For 50 - 120 °C)	PCR12000 Series	SR 21 350 Series (Ag based) SR 20 150 Series (AgPd based)	
Dielectric/ Overglaze/ Soldermask	Dielectric: UVD5800 Series	Dielectric: UVD5800 Series	Dielectric: IP6075 IP6080 Soldermask: SM1000	Dielectric: SD1010A (For 430 Stainless Steel)	Dielectric: GPA2014-089 (For 304 Stainless Steel)
				Overglaze: SD1019	



PRODUCTION SITES

Hanau, Germany | Chisoda, Romania | West Conshohocken, USA | Kulaijaya, Malaysia | Changshu, China | Shanghai, China | Zhaoyuan, China | Incheon, Korea | Singapore

SERVICE LABS

Hanau, Germany | West Conshohocken, USA | Changshu, China | Shanghai, China | Singapore

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