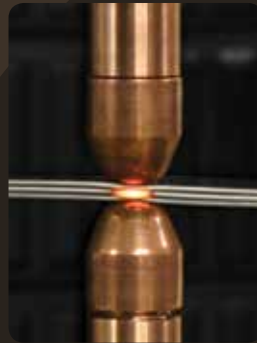
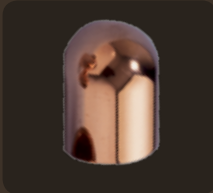




lebronze alloys



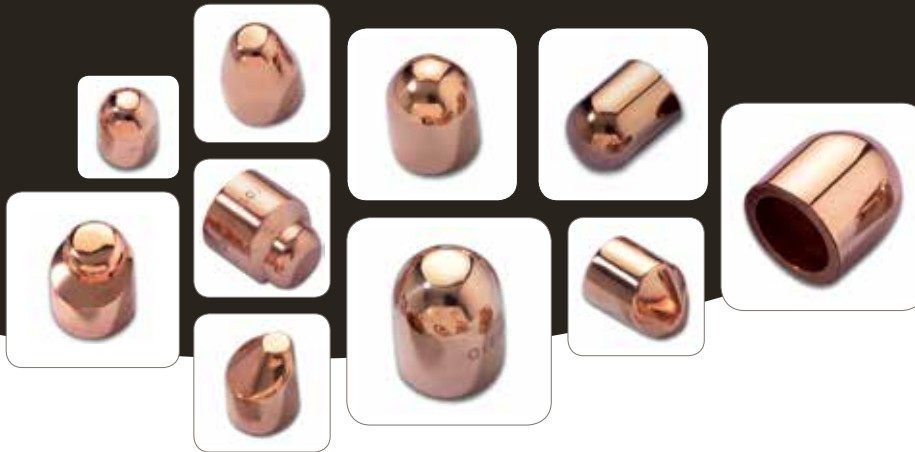
Powerode<sup>®</sup>

the universal high performance electrode

# Powerode®: a dedicated and exclusive process

Lebronze alloys has always been committed to a process of continuous improvement. This allied with a Research & Development programme launched in partnership with specific automotive manufacturers led to the set up of a dedicated and exclusive patented manufacturing process for the electrodes. The welding performance of Powerode® and its revolutionary electrodes offers improvements in comparison with the highest standards available within this sector.

Powerode® is available in all cap types for both CuCrZr cold-formed and machined electrodes.



## Powerode® positives

### ► Market leading purity

Composition		Standard	Powerode®
% Cr	min	0.45%	0.45%
	max	1.00%	0.80%
% Zr	min	0.03%	0.03%
	max	0.15%	0.09%
Total impurities including Fe + Si	max	0.38%	0.15%

### ► Higher conductivity

Composition		Standard	Powerode®
Resistivity in $\mu\Omega\text{cm}$	min		
	average		2.05
	max	2.30	2.15
Conductivity in %IACS	min	75%	80%
	average		85%
	max		
Conductivity in MS / m	min	43.5	46.5
	average		48.8
	max		
Variation within batch			5%

### ► Higher resistance to softening

Composition		Standard	Powerode®
Hardness in HV as delivered	min	160	165
	average		175
	max		
	variation within batch		
Hardness in HV after heat treatment at 500°C for 8 hours	min	90	125
	average	125	145
	max		
	variation within batch	50%	10%

### ► Self-protecting layer

Whilst welding Powerode® generates a self-protecting layer which inhibits the corrosion of the welding cap.

#### STANDARD CAPS

No protective layer: "tearing" effect



Surface damage requires frequent tip-dressing.

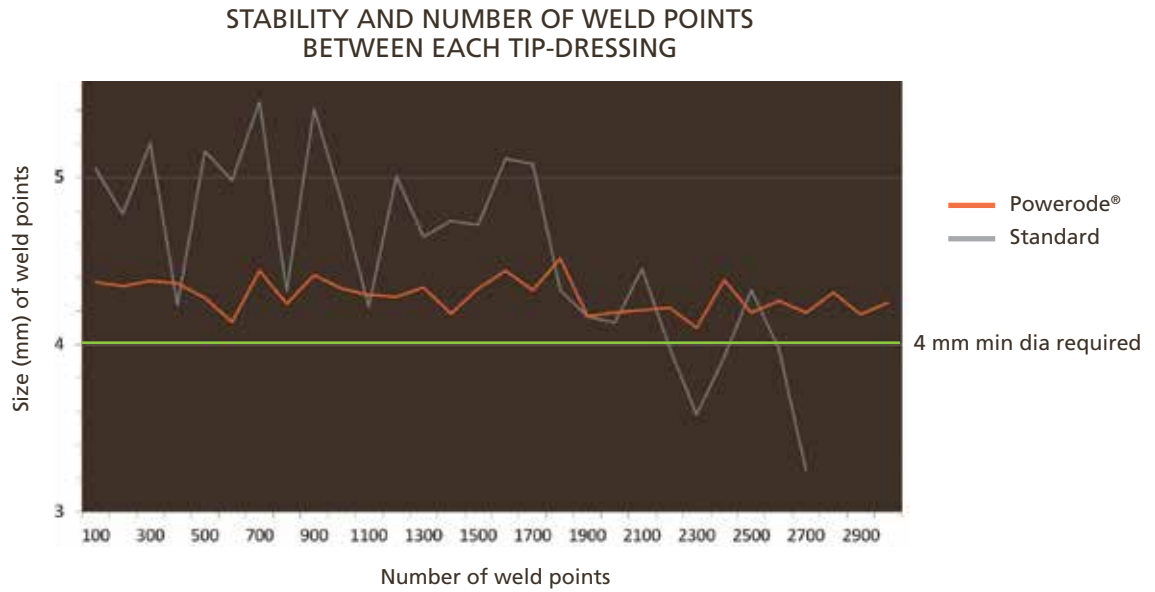
#### POWERODE® CAPS

Effective and stable protective layer



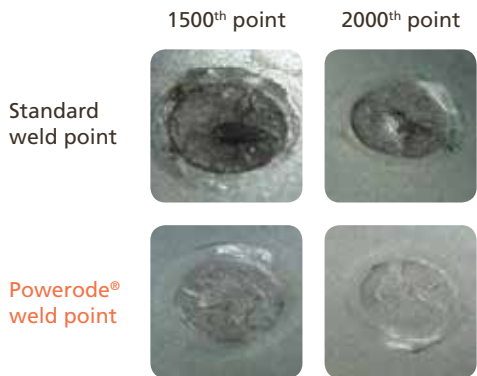
Powerode® properties ensures both tip-dressing and corrosion are reduced.

► Stable, repeatable and enhanced results



Unlike standard electrodes, **Powerode®** guarantees a stable spot size and maintains performance, even when exceeding 2000 points.

► Improved aspect and no sticking effect



Standard caps: a degradation appears after 1500 spot welds. This effect increases with the number of spots: 50% of spot welds have potential quality issues and risk of sticking increases.

**Powerode® caps: weld point remains nice and stable all along life cycle. Risk of sticking is drastically reduced.**

► Reduction in tip-dressing

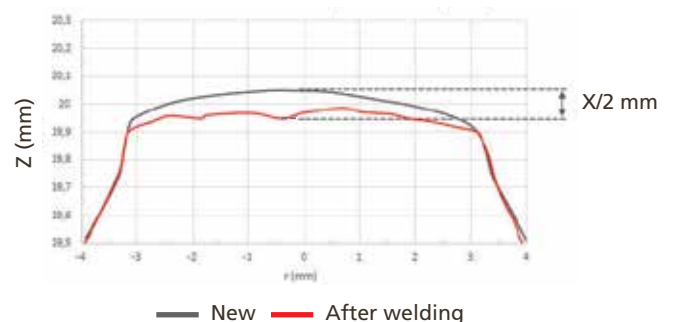
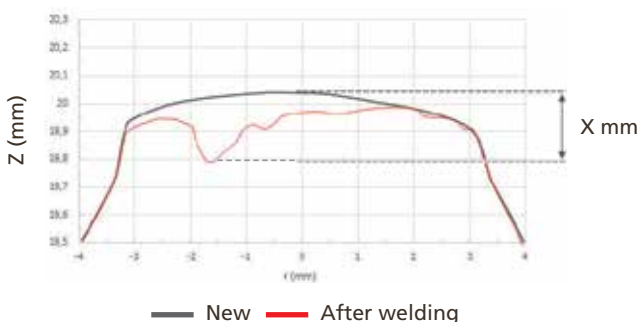
**Powerode®** inhibits damage to the electrode surface which reduces the amount of material to be removed during dressing.



**STANDARD ELECTRODE EROSION**



**POWERODE® ELECTRODE EROSION**



## Other products for resistance welding applications



- Rods and hollows from 8 to 380 mm OD
- Flats, squares and plates from 10 mm thickness
- Seam welding wheels up to 900 mm OD
- Stamped and machined connectors for welding guns



## Experts in resistance welding

For over 50 years, Lebronze alloys has been an international reference in the Automotive industry for resistance welding products. Our expertise, firstly developed in France and Germany, is now recognized in 35 countries. Being a major partner to almost all car builders involves important duties: not only manufacturing high quality alloys and electrodes but also by being a pioneer in innovation.

All our products are manufactured 100% in our own dedicated facilities where melting, casting, extrusion, drawing, heat treatment, machining and cold forming operations, are permanently controlled by our experienced Engineering and Quality Assurance staff. This uniqueness guarantees complete traceability and thus perfect control of quality, and improves the reliability of our supply chain.



Alloy	Standards <i>Nearest international standards</i>	Nominal composition %										Physical properties						Mechanical properties																
		Cu	Cr	Zr	Co	Be	Ni	Fe	Si	Others	Density	Electrical conductivity % IACS	Electrical resistivity at 20°C μΩcm	Thermal conductivity 20° to 200°C W/mK	Coeff. of expansion 20° to 200° °C x 10 <sup>-6</sup> K <sup>-1</sup>	Relative magnetic permeability	Young's modulus kN/mm <sup>2</sup>	Conditions																
		<i>TER = Quenched, cold worked and aged</i> <i>TR = Quenched and aged</i> <i>T = Quenched</i>																Tensile strength	Yield strength 0.2% offset	Elongation 5.65 % S	Hardness													
																		Mpa ≥ ; * = Mpa ≤	ksi ≥ ; * = Mpa ≤	Mpa ≥	ksi ≥	% ≥	HB	HRB										
Powerode®	ASTM: C18100-C18150 MIL 19311 RWMA class 2 SAE CA 184 BS 2874 CC 102 EN 12163, EN 12165, EN 12420, EN 12167 CW106C, CW105C DIN 17666 WN 2.1293 DIN 17672 DIN 44759 NFA 82100 ISO 5182 A2/3 ISO 1336	Remainder	0,45 to 0,8	0,03 to 0,09						≤ 0,08	≤ 0,2	8,9	≥ 80	≤ 2,15	320	17,5	1,01	120	Cold formed Electrodes 13 ≤ Ø ≤ 20 mm - 0,5 in. ≤ Ø ≤ 0,8 in.							160								
																			Machined Electrodes 10 ≤ Ø ≤ 40 mm - 0,40 in. ≤ Ø ≤ 1,57 in.															150
CuCr1Zr CRM16 C18150	ASTM: C18100-C18150 MIL 19311 RWMA class 2 SAE CA 184 BS 2874 CC 102 EN 12163, EN 12165, EN 12420, EN 12167 CW106C, CW105C DIN 17666 WN 2.1293 DIN 17672 DIN 44759 NFA 82100 ISO 5182 A2/3 ISO 1336	Remainder	0,4 to 1	0,03 to 0,15						≤ 0,08	≤ 0,2	8,9	≥ 75	≤ 2,3	320	17,5	1,01	120	Round rod 10 ≤ Ø ≤ 25,4 mm - 0,40 in. ≤ Ø ≤ 1 in.	480	70	420	61	18	150									
																			Square, flat, hexagone, thickness 10 ≤ Ø ≤ 25,4 mm 0,40 in. ≤ Ø ≤ 1 in. TER condition															
																			Round rod 26 ≤ Ø ≤ 45 mm - 1. in. < Ø ≤ 1,80 in.	480	70	420	61	18	140									
																			Square, flat, hexagone, thickness 26 to 60 mm 1,02 in. to 2,4 in. TER condition															
																			Round rod 45 < Ø ≤ 80 mm - 1,80 in. < Ø ≤ 3,15 in. Temper TR	440	64	360	52	18	140									
Round rod 20 ≤ Ø ≤ 350 mm - 0,80 in. ≤ Ø ≤ 13,8 in.	350	51	240	35	20	120																												
Square, flat of equivalent section TR condition																																		
Plate 16 ≤ thickness ≤ 250 mm - 0,60 in. ≤ thickness ≤ 10 in. TR condition	380	55	280	41	20	120																												
Plate 4 ≤ thickness ≤ 10 mm - 0,16 in. ≤ thickness ≤ 0,40 TER condition	400	58	350	51	10	125																												
CuCr1Zr CRM16E C18150	ASTM: C18100-C18150 MIL 19311 RWMA class 2 SAE CA 184 BS 2874 CC 102 EN 12163, EN 12165, EN 12420, EN 12167 CW106C, CW105C DIN 17666 WN 2.1293 DIN 17672 DIN 44759 NFA 82100 ISO 5182 A2/3 ISO 1336	Remainder	0,4 to 1	0,03 to 0,25						≤ 0,08	≤ 0,2	8,9	≥ 75	≤ 2,3	320	17	1,01	120	Discs and rings TR condition															
																			380	55	280	41	15	130										
CuZr ZR16X C15000	ASTM: C15000 RWMA class 1 DIN 17666 wn 2.1580 DIN 17672 ISO 5182 A2/4 EN 12163, EN 12167, EN 12420 CW120C	Remainder	0,15									8,9	≥ 85	≤ 2,05	320	17	1,01	110	TER condition															
																			320	46	280	41	18	120										
CuCo2Be CB4	BS 2874 CC 112 DIN 17666 wn 2.1285 DIN 17672- DIN 44759 ISO 1187- NFA 82100 ASTM B441- B534- B 870: C 17500 MIL 46087- RWMA class 3 SAE CA 184	Remainder			2,2	0,5						8,9	≥ 38	≤ 4,5	200	17,5	1,01	130	Section < 1000 mm <sup>2</sup> - < 1,550 in. <sup>2</sup> TR or TER condition	700	101	650	94	10	240									
																			Section ≥ 1000 mm <sup>2</sup> - ≥ 1,550 in. <sup>2</sup> TR condition	700	101	550	80	15	220									
CuNi2Be NB4	RWMA class 3 , ASTM B 441 and B534 C17510 alloy DIN 17666 WN 2,0850 DIN 17672 EN 12163 CW110C	Remainder										8,9	≥ 45	≤ 3,83	230	17	< 1,01	130	Rods TR (TF00, AT)	690	100	520	75	9	230	98								
																			Outer diameter: 12,7 - 304,8 mm ( 0,5" - 12")															
																			Rods TR (TH04, HT)	760	110	660	95	9	240	100								
																			Outer diameter: 12,7 - 50,8 mm (0,5" - 2")															
																			Rods T (TB00, A)	240	35	70	10	20	≤ 95	≤ 50								
																			Outer diameter: 12,7 - 304,8 mm ( 0,5" - 12")															
Rods TE (TD04, H)	450	65	320	45	15	120	70																											
Outer diameter: 12,7 - 50,8 mm (0,5" - 2")																																		
Plates TR (TF00, AT) Width: 305 - 686 mm (12" - 27")	690	100	550	80	10	230	98																											
Thickness: minimum 19,05 (3/4") maximum section: 70 000 mm <sup>2</sup> ( 108 in <sup>2</sup> )																																		
Plates T (TB00, A) Width: 305 - 686 mm (12" - 27")	240	35	170	25	20	≤ 90	≤ 45																											
Thickness: minimum 19,05 (3/4") maximum section: 70 000 mm <sup>2</sup> ( 108 in <sup>2</sup> )																																		
CuBe2 CBE2 C17200	ASTM B196: C 17200 AMS 4533: C17200 AMS 4535: C17200 RWMA class 4 QQC 530 DIN 17666, DIN 17672 wn 2.1247 NFL 14709 EN 12163 CW 101C	Remainder			> 0,2	1,8 to 2						8,3	28	6	110	17	1,01	130	Discs 200 ≤ Ø ≤ 400 mm 7,9 in. ≤ Ø ≤ 15,7 in.	1050	152	850	123	2	320									
																			Plate 25 ≤ thickness ≤ 250 1 in. ≤ thickness ≤ 10 in.	1140	165	965	140	2	340									
																			Rods 19,05 ≤ Ø ≤ 50,8 mm 0,75 in. ≤ Ø ≤ 2 in. TER condition	1240	180	1061	154	3	360									
																			Rods 50,8 ≤ Ø ≤ 76,2 mm 2 in. ≤ Ø ≤ 3 in. TER condition	1210	175	1040	151	4	360									
																			Rods 19,05 ≤ Ø ≤ 150 mm 0,75 in. ≤ Ø ≤ 5,9 in. TR condition	1150	167	965	140	4	340									
																			Rods 19,05 ≤ Ø ≤ 150 mm 0,75 in. ≤ Ø ≤ 5,9 in. T condition	570	83			35	150	80								
																			Rings TR condition	1050	152	850	123	2	320									
CuNi2Si NS5 C18000	DIN 17666 wn 2.0855 DIN 17672 wn 2.0855 DIN 44759 cl A3.2 NFL 14-701 ISO 1187 EN 12163, EN 12167, EN 12420, EN 12165 CW111C DTD 498	Remainder										8,8	38	4,5	180	16	1,01	130	Section ≤ 1000 mm <sup>2</sup> - ≤ 1,55 in. TER temper	650	94	590	86	10	≥ 195									
																			1000 < section ≤ 2800 mm <sup>2</sup> - 1,55 in. <sup>2</sup> < section ≤ 4,3 in. <sup>2</sup> TR temper	650	94	500	72	10	≥ 195									
																			2800 < section ≤ 60 000 mm <sup>2</sup> - 4,3 in. <sup>2</sup> < section ≤ 93 in. <sup>2</sup> TR temper	590	86	440	64	8	≥ 190									
																			Section > 60 000 mm <sup>2</sup> - section > 93 in. <sup>2</sup> TR temper	490	71	340	49	8	≥ 160									
CuNi2Si NS6 C18000	RWMA class 3: C18000	Remainder	0,6									8,8	≥ 45	≤ 3,83	180	16	1,01	130	Rods 12,7 ≤ Ø ≤ 25,4 mm - 0,5 in. ≤ Ø ≤ 1 in.	655	95	590	86	9	≥ 195	≥ 90								
																			Rods 25,4 ≤ Ø ≤ 50,8 mm - 1 in. ≤ Ø ≤ 2 in.	650	94	500	72	9	≥ 195	≥ 90								
																			Rods 50,8 ≤ Ø ≤ 114,3 mm - 2 in. ≤ Ø ≤ 4,5 in.	610	88	500	72	9	≥ 195	≥ 90								
																			Rods 114,3 ≤ Ø ≤ 381 mm - 4,5 in. ≤ Ø ≤ 15 in.	610	88	345	50	9	≥ 195	≥ 90								
																			Square, rectangle Section ≥ 500 mm <sup>2</sup> - section ≥ 0,77 in. <sup>2</sup> , thickness ≤ 25 mm - thickness ≤ 1 in.	655	95	590	86	9	≥ 195	≥ 90								
																			Square, rectangle Thickness > 25 mm - thickness > 1 in.	610	88	345	50	9	≥ 195	≥ 90								
																			Forged Plate 19 ≤ thickness ≤ 25 mm - 0,75 in. ≤ thickness ≤ 1 in.	650	94	345	50	9	≥ 195	≥ 90								
																			Forged plate 25 ≤ thickness ≤ 51 mm - 1 in. ≤ thickness ≤ 2 in.	620	90	345	50	9	≥ 195	≥ 90								
Forged plate Thickness > 51 mm - thickness > 2 in.	610	88	345	50	9	≥ 195	≥ 90																											





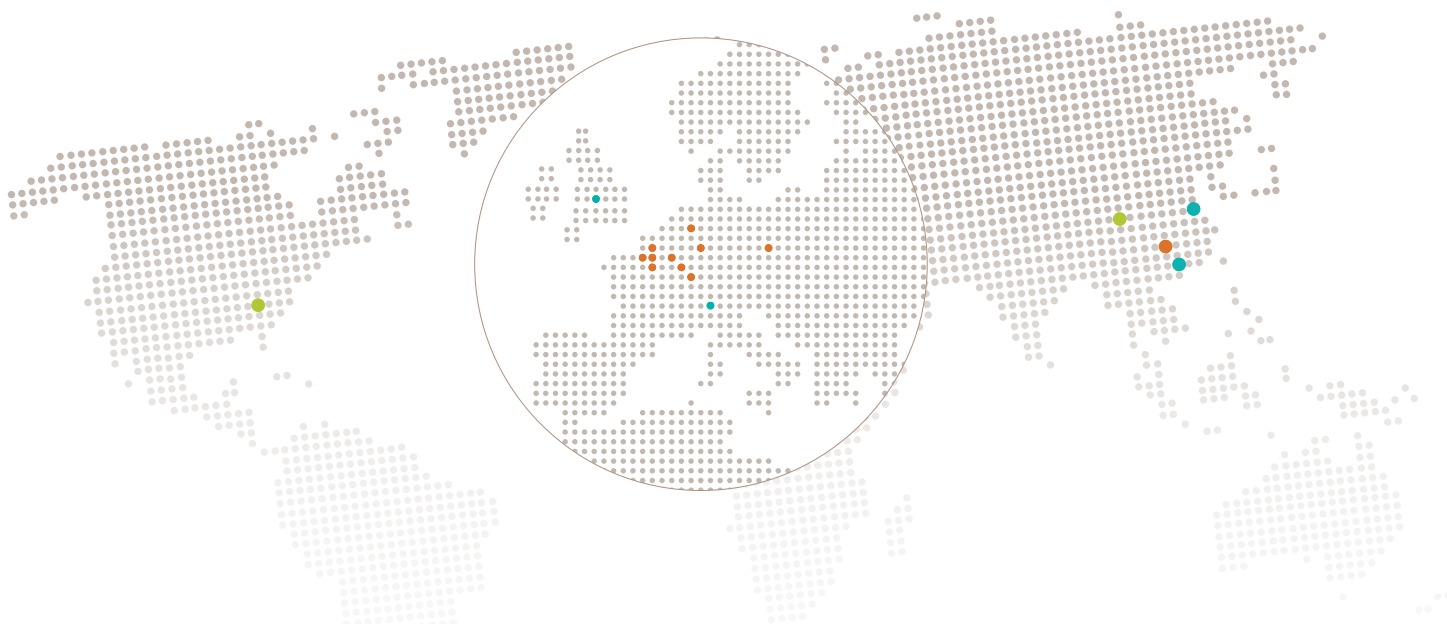
# lebronze alloys

Lebronze alloys Group was born from the integration of different companies specializing in development and production of technical high performance alloys components : copper alloys, nickel alloys, but also aluminium alloys, specialty steels, stainless steels, titanium and nickel superalloys.

Thanks to a multidisciplinary know-how, the Group provides innovative solutions to all major industries such as Aerospace, Power, E-mobility, Oil & Gas, Railway but also in sectors manufacturing smaller equipment and products.

Our 14 production facilities and 1,300 employees manage a unique range of metal processing technologies: continuous and semi-continuous casting, sand casting, die precision chill casting, centrifugal casting, extrusion, ring rolling, hot and cold rolling, drawing, open-die forging, hot stamping, closed-die forging, cold forming, machining, non-destructive testing, etc.

The Group's commitment is to find appropriate and optimized solutions for every sector's requirements.



**LT** Lebronze Tuffaloy  
North America

● Greer, SC



lebronze alloys

- Bornel
- Breteuil
- Custines
- Dangu
- Sélestat
- Suippes
- Taverny
- Pescheria Borromeo (IT)



lebronze alloys | Germany

- Lüdenscheid
- Siegen



lebronze alloys | UK

- wolverhampton



● Xi'an, China



lebronze alloys | Poland

- Rydzyna



lebronze alloys | Asia

- Hong-Kong



lebronze alloys | China

- Dongguan
- Suzhou

● Production site   ● Sales office   ● Joint-Venture

[www.lebronze-alloys.com](http://www.lebronze-alloys.com)