

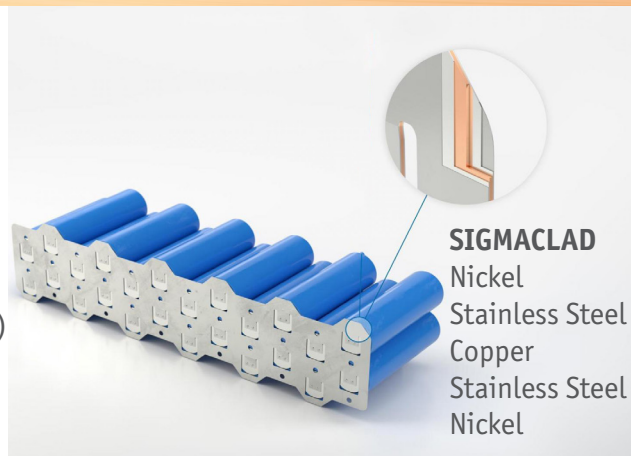
Your COOLEST Connector Plate High Conductivity that's Actually Weldable

Material Attributes

- › Conductivity (% IACS): 40% / 60% / 80%
- › Surface: Medium Luster matte Finish
- › Temper: Annealed (other specific tempers on request)
- › Thickness: 0.15 - 0.50 mm
- › Width: 25.4 - 600 mm

Advantages

- › High electrical & thermal conductivity for lower battery pack operating temperatures
- › Easily welded by resistance or laser
- › Stainless layers promote higher weld strength and fatigue resistance
- › High conductivity allows for designing thinner, lighter, lower cost battery connector
- › Nickel surface layers for soldering and additional corrosion resistance



SIGMACLAD
Nickel
Stainless Steel
Copper
Stainless Steel
Nickel

Physical Properties 20°C

	SIGMACLAD 40 annealed	SIGMACLAD 60 annealed	SIGMACLAD 80 annealed	201 Nickel annealed	Ni Plated Steel AISI 1020
Density (Kg/m ³)	8,415	8,580	8,666	8,900	7,870
Yield Strength (MPa)	205	138	93	103	350
Tensile Strength (MPa)	475	368	282	414	420
Elongation (%)	45	48	43	45	15
Erichsen cup Height (mm)	11.2	11.9	N/A	12.1	N/A
Elastic -Modul (GPa)	165	148	131	207	186
CTE (µm/m°C)	16.6	16.7	17.1	13.3	11.7
Thermal Conductivity parallel (W/m-K)	178	253	317	79	52
Specific Heat (J/Kg-°C)	447	423	413	456	486
Thickness (mm)	0.15 - 0.30	0.20 - 0.50	0.50	N/A	N/A

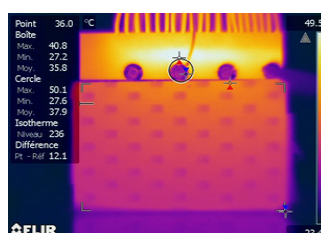
Properties can vary depending on finish thickness

Electrical Properties 20 °C

	SIGMACLAD 40 annealed	SIGMACLAD 60 annealed	SIGMACLAD 80 annealed	201 Nickel annealed	Ni Plated Steel AISI 1020
Conductivity (% IACS)	40%	60%	80%	20%	11%
Resistivity (Ω-m)	4.310 x 10 ⁻⁸	2.874 x 10 ⁻⁸	2.115 x 10 ⁻⁸	8.621 x 10 ⁻⁸	1.567 x 10 ⁻⁸



Thermal Image after 5 minutes discharge with 0.250 mm Nickel/0.250 mm Copper welded assembly endplate.
Point temperature 54.5 °C



Thermal Image after 5 minutes discharge with 0.508 mm SIGMAclad welded assembly endplate.
Point temperature 36.0 °C

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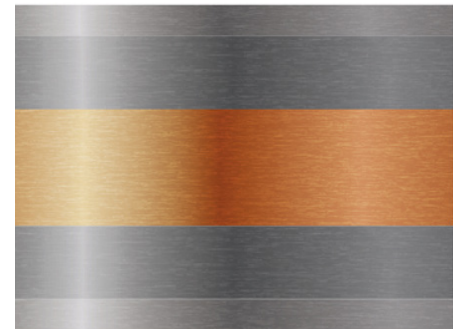
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Welding & Joining Possibilities

SIGMACLAD is a perfect joining solution for cylindrical Li-ion battery cells. All **SIGMACLAD** materials are easily soldered, resistance welded, or laser welded. EMS Applications Engineers can assist customers with cell connector design features for optimal welding.

SIGMACLAD as connector material welds readily through the use of anti-shunt slots, weld projections, and/or a step welding process. Excellent pull strengths are observed for all conductivities and strip thicknesses. Good solderability is observed for all **SIGMACLAD** variants using a Sn/Cu solder with a rosin core.



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* Reference the Engineer Design Guide for more details

Material & Thickness	Electrode Configuration	Anti-Shunt Slot / Projection	Watt Seconds	Pull Strength (kg) Cathode/Anode
SIGMACLAD 40 0.127 mm	parallel	Yes/No	65	5.4/6.4
SIGMACLAD 40 0.25 mm	parallel	Yes/No	150	23/28
SIGMACLAD 60 0.40 mm	parallel	Yes/No	275	23/31
SIGMACLAD 60 0.50 mm	parallel	Yes/No	500	48/35
SIGMACLAD 60 0.50 mm	step	No/Yes	150	38/38

* Welding method required depends on bulk thickness and electrical conductivity.

SIGMACLAD vs. Competitive Materials

	Solderability	Weldability	Conductivity (IACS) ¹	Corrosion Resistance	Thermal Distribution Capability	Formability	Price
SIGMACLAD ⁴	excellent	excellent	40 - 80%	excellent	high	excellent	good
Copper	good	fair	100%	poor	high	excellent ⁶	good
Aluminum	poor	poor	60%	poor	high	fair	excellent
Copper Alloy (FAS-680)	excellent	fair	40%	poor	medium	fair	good
Nickel Plated Steel	excellent	excellent	11 - 15%	poor ⁵	low	excellent	excellent
Nickel ³	excellent	excellent	18 - 22%	excellent	low	good	poor
Phosphor Bronze ²	excellent	fair	11 - 20%	fair	low	fair	good

¹ IACS % relative to pure Copper

² Tin Plated

³ Nickel rating is based on as rolled condition and smooth finish

⁴ SIGMAclad comprises proprietary surface conditions

⁵ All exposed edges corrode

⁶ Erichsen Cup Test



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