Engineered Materials Solutions
Wickeder Group

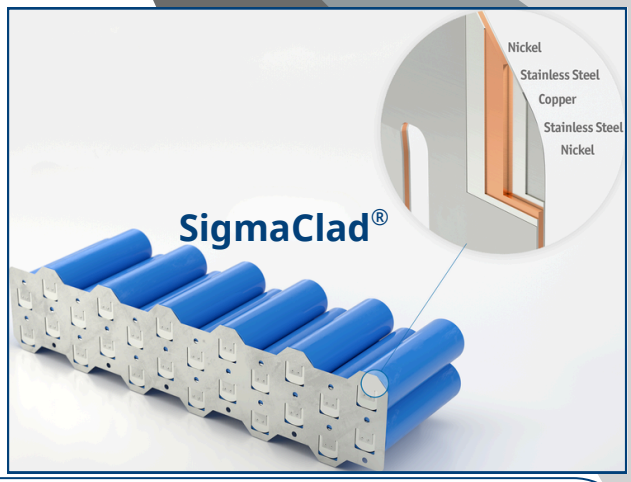
SIMGACLAD®
the COOLEST connector plate

High Conductivity Meets Weldable

The performance of the battery pack is critical. This includes the battery design as well as the current collector that joins multiple batteries together.

For the current collecting tab material, higher conductivity and less loss are desired because that means:

- Energy goes to the performance of the device and is not lost as heat
- Charge and discharge rates of the batteries improve
- Longer operation before a charge is needed



SigmaClad 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

Physical Properties 20°C

	SigmaClad 40 annealed	SigmaClad 60 annealed	SigmaClad 80 annealed	201 Nickel annealed	Ni Plated Steel AISI 1020
Density (Kg/m³)	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	.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)	4.310×10^{-8}	2.874×10^{-8}	2.115×10^{-8}	8.621×10^{-8}	1.567×10^{-8}

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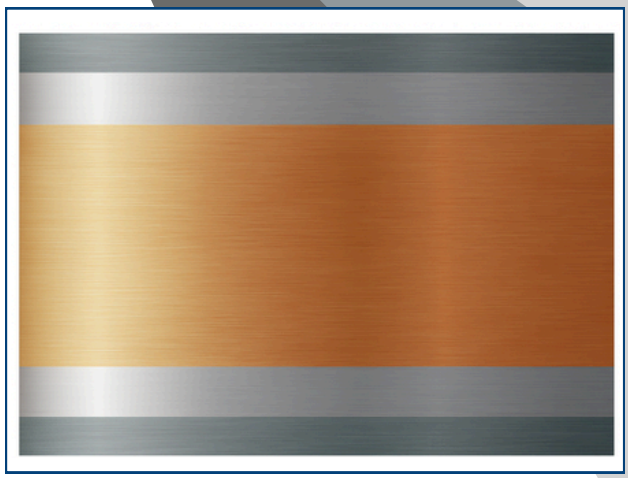
Welding & Joining Possibilities

SigmaClad is a perfect solution for cylindrical Li-ion battery cell current collector plates. One of the biggest advantages of SigmaClad is its flexibility and durability in welding and joining applications.

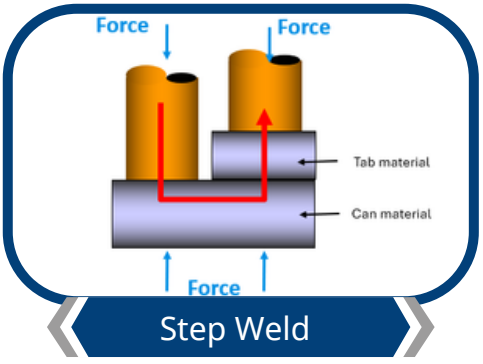
- Easily soldered, resistance-welded, or laser-welded
- Readily resistance-welded using anti-shunt slots and weld projections
- Parallel welding is recommended for thinner gauges
- Step welding recommended for thicker gauges (>0.03 mm)
- Resistance weld pull tests typically break between 72 and 88 lbs.
- Laser weld pull tests exceed 200 lbs. without breaking



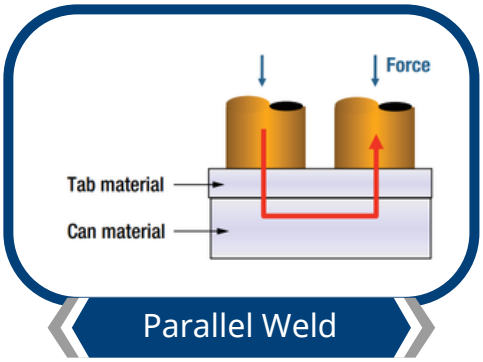
SigmaClad 5 Layer Clad Metal

Nickel
Stainless Steel
Copper
Stainless Steel
Nickel

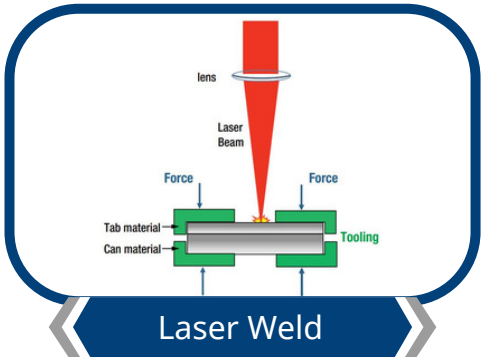
SigmaClad Weld Diagrams



Step Weld



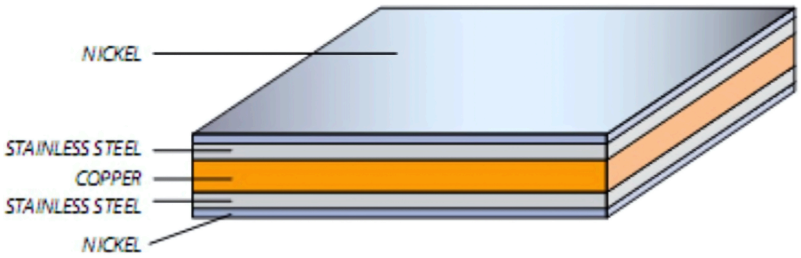
Parallel Weld



Laser Weld

Material Attributes

- **Conductivity (% IACS):** 40% / 60% / 80%
- **Surface:** Medium Luster matte Finish
- **Temper:** Annealed
- **Thickness:** 0.006" - 0.020"
- **Width:** 1" - 23"



SigmaClad Options

SigmaClad 40%
- 0.15mm (0.006")
- 0.20mm (0.008")
- 0.25mm (0.010")
- 0.30mm (0.012")

SigmaClad 60%
- 0.20mm (0.008")
- 0.30mm (0.012")
- 0.40mm (0.016")
- 0.50mm (0.020")

SigmaClad 80%
- 0.50mm (0.020")

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