

Clad Metal Solutions

Your most ambitious ideas —

materialized



MATERION



Clad Metals Bring Advanced Technologies to Life

Material limitations should never hold back your innovative spirit.

The pace of technology advancement is unprecedented. And as designs and applications grow increasingly complex, materials need to stand up to new, more rigorous demands. Sometimes traditional materials just won't get you there; that's where Materion clad metals take over.

Our clad metal solutions can be tailored to your needs, whether an application requires exceptional strength, lightness, thermal conductivity, corrosion resistance or some other property. We'll work with you to identify or custom-engineer clad metals that provide all the attributes and capabilities you need to ensure the functionality, performance and durability of your designs.

Browse through this e-book to see some of the types of clad metals we produce and how these materials are being used in consumer electronics, automotive, health care and alternative energy applications. And feel free to reach out to us any-time to discuss a particular project, design, challenge or need.

We're as excited about the next phase of innovation as you are. Our clad metal solutions can help you make it happen.

Clive Grannum

President

Performance Materials

Spread the heat without
adding volume

eStainless® Clad



Smaller, cooler, more reliable
EV battery connections

Dovetail Clad®



DC chargers that stand
up to heat and wear

iON EV™ Clad



High performance, stability
and reliability under the hood

Additional iON
Connector Materials



Durability and reliability for
critical circuitry

Wire Bondable Lead
Frame Materials



Custom-designed for precision
electronics applications

Metal Strip
Resistor Materials



How Innovation Takes Shape

Today's sophisticated technologies require a whole new way of thinking — and a whole new set of materials.

Clad metals offer solutions to the challenges that keep you up at night. Whether those challenges are related to electrical, mechanical, thermal, chemical or other types of performance demands, you can meet them head-on by thinking beyond a single material to the virtually limitless potential of cladding. A single material may deliver some of the properties you need, but what if you could combine the property sets of dissimilar metals to completely fulfill that need?

Materion offers you that capability. Our expertise in cladding metals can open a new world of possibilities for innovation and performance. We work with more than 200 alloys ranging from steel, copper, titanium and aluminum to refractory and precious metals — giving you options you may not have considered before. Our clad metal solutions just might be the next-generation materials your next-generation designs have been waiting for.

OVERCOME THE CHALLENGES

What's holding you back? Clad metals can address a variety of challenges to keep your innovation on track:

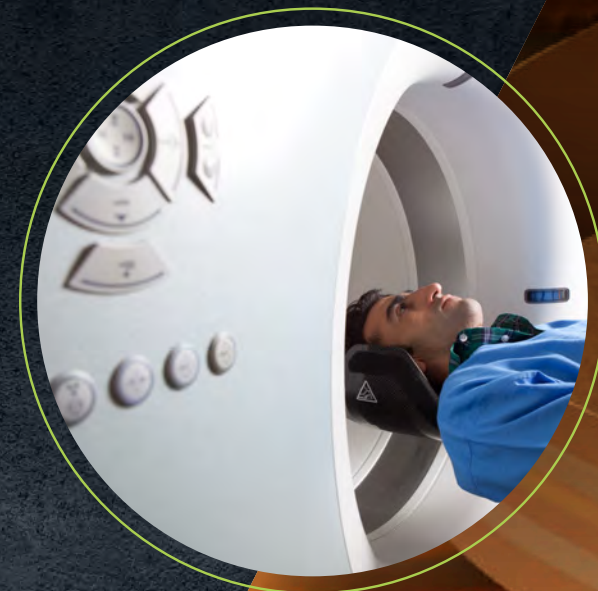
- THERMAL MANAGEMENT
- EXTREME VIBRATION
- HIGH VOLTAGE
- GALVANIC CORROSION
- LIGHTWEIGHTING
- CONTACT RESISTANCE OR WELDING

EMBRACE THE OPPORTUNITIES

Materion offers Dovetail Clad, eStainless, iON EV Clad and a variety of cladding technologies that can be combined to create unique, customized solutions:

- ELECTRON BEAM WELDING
- INLAY OR OVERLAY CLADDING
- PROFILING – MILLING, GRINDING OR SKIVING
- NICKEL AND TIN ELECTROPLATING
- SOLDER LAYERING

the virtually
limitless
potential of cladding



Spread the Heat Without Adding Volume

Handheld and mobile devices benefit from the duality of eStainless materials: They enable the production of thinner, stiffer, lighter components that also conduct and dissipate heat. Materion creates these fully formable metal laminates by cladding aluminum or copper with stainless steel. The resultant materials maintain high stiffness with 10 to 18 times the conductivity of conventional stainless steel components.

eStainless Clad Cu is ideal as a high-conductivity replacement for stainless steel, enabling heat spreading functionality to be designed directly into the structure of devices. Lightweight eStainless Clad Al can replace thicker components without sacrificing strength or thermal requirements. Integrated heat spreaders made of eStainless Clad reduce the need to add specialty thermal management solutions, resulting in cost, as well as internal space, savings.

Key Benefits

- High strength
- High thermal management
- Lightweighting



10-18x
higher thermal conductivity
than stainless steel

Dovetail Clad®

Smaller, Cooler, More Reliable EV Battery Connections

High-volume,
low-cost
laser assembly



The breakthrough Dovetail Clad technology, developed by Materion engineers in collaboration with leading battery manufacturers, solves the issues related to electric vehicle (EV) and hybrid electric vehicle (HEV) battery connections.

We join two dissimilar materials, copper and aluminum, side-by-side in long master coils that can be stamped and formed into bus bars and lead tabs designed to fit EV and HEV lithium-ion battery packs.

Dovetail Clad metal offers mechanical, electrical and thermal advantages over ultrasonic or bolted attachments and enables high-volume, low-cost laser assembly. As EVs continue to grow in popularity, Dovetail Clad can help you meet increasing demand without breaking your budget.

Key Benefits

- The lowest electrical resistance available, resulting in significantly cooler pack temperatures
- The highest life-testing reliability in mechanical and fatigue strength
- Outstanding formability enables more compact module designs
- Narrow Cu-Al joint width (less than 4mm) for design flexibility

/ iON EV™ Clad

DC Chargers that Stand Up to Heat and Wear

Wear resistance exceeds
10,000
connection cycles

Direct current (DC) fast chargers offer EV drivers exceptional convenience, enabling them to recharge their vehicles in less than 30 minutes instead of several hours. But the harsh conditions created by the heat and power generated during those charging sessions puts tremendous strain on the connectors.

iON EV is a proprietary silver alloy composite that optimizes the reliable qualities of silver to create a superior replacement for pure silver, which in itself cannot provide the hardness required to resist wear in rapid-charge applications. By enhancing the friction characteristics of the contact surface, iON EV Clad ensures components can withstand the high-current environment.

Key Benefits

- Wear resistance
- Stable performance at elevated temperatures



High Performance, Stability and Resistance Under the Hood

Automotive system designers and engineers face the challenge of achieving electrical stability under the hood, where temperatures can reach 200°C and vibrations can become quite intense. Materion has engineered a variety of diffused layer alloys as alternatives to electroplated contact surfaces. The dense microstructure of these iON materials imparts heat- and corrosion-resistant properties to the contacts, and enhances both performance and stability.

Key Benefits

- High performance and stability (outperforms electroplating)
- Reduced gold content per connector
- Formulations tailored to each specific application



achieve

electrical stability under
intense conditions



Stainless Connector Clad Solutions

Stainless clad materials offer another automotive alternative. Like our iON connector alloys, they provide stable electrical contact over long periods in high temperatures and extreme conditions, but these materials are created from a stainless steel-based system inlaid with a thermally stable, high-performance, multilayer gold-palladium alloy.

/ Wire Bondable Lead
Frame Materials

Durability and Reliability for Automotive Circuitry



High temperature
and vibration
stability

Cladding offers a more durable, high-performing solution than traditional plated metals for lead frames in automotive electronic circuits. For wire bonding applications, where reliability and high-power linkages are essential — in the connections between microelectronic circuitry and the macro-scale wiring systems of passenger cars, for example — bonding aluminum wire to aluminum pads offers the highest processing yields.

Integrating the aluminum pad directly into the lead frame via inlay clad is ideal for safety-critical applications, such as electronic power steering modules and anti-lock brake systems. Materion uses reel-to-reel processes to produce semi-finished lead frame materials, enabling large-volume manufacturing of high-reliability electronic packaging materials.

Key Benefits

- Large wire bonding process windows and high yields
- High reliability life performance
- Nontoxic and lead-free materials



/ Metal Strip Resistor Materials

Custom-Designed for Precision Electronics and High Power Demands

For medical devices, lithium-ion batteries, handheld electronics and more, Materion's metal strip resistor materials enable the production of highly stable and reliable components across a broad range of dimensions and ohmic values. A wide variety of resistance alloys and geometries are available to create solutions ranging from surface mount designs to high-current shunts.



Reliable components across a **broad range** of dimensions and ohmic values

Our welded and clad resistor materials are engineered for specific applications and can combine various hybrid-material technologies.

ELECTRON BEAM WELDING

A unique, continuous strip welding process, which securely joins materials side by side with narrow fusion zones and precise resistive widths, creating a solution with superior performance.

OTHER SUPPORTING TECHNOLOGIES

- **Inlay or Overlay Cladding**, designed to minimize footprint and achieve low resistive values
- **Profiling** — including milling, grinding or skiving — through which multiple grooves can be provided in a single wide coil. Materion's advanced profiling technology enables virtually unlimited design possibilities for use in high-speed stamping.
- **Nickel and Tin Electroplating**, which protects against corrosion
- **Solder Layers**, which facilitate mounting

Key Benefits

- Flexibility to achieve specific application requirements
- Versatility for designers of complex stamped parts

