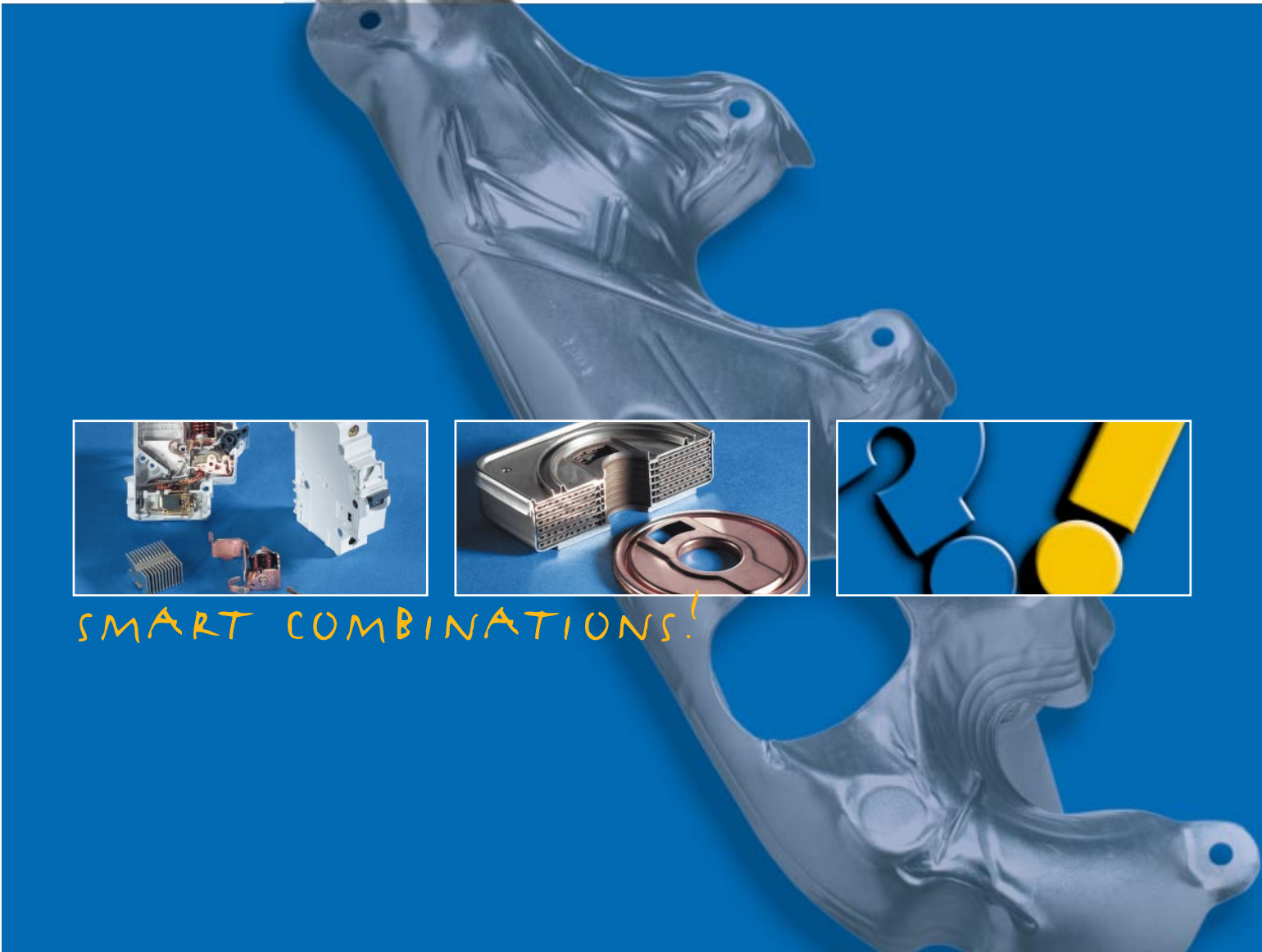
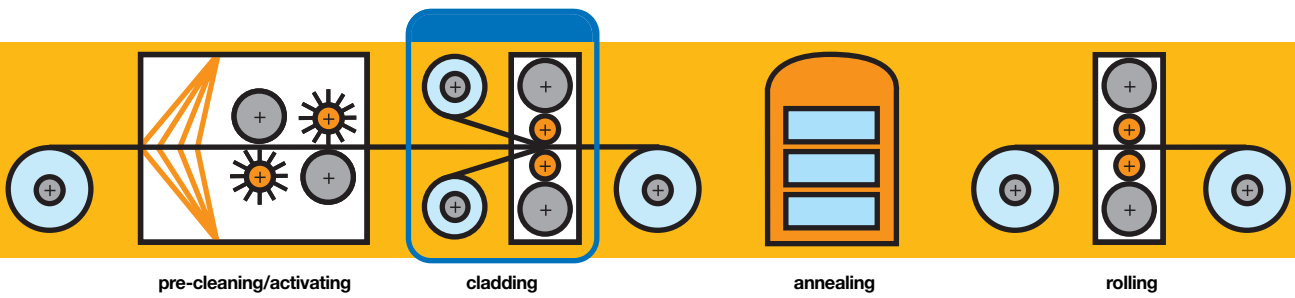


**Clad  
materials**



SMART COMBINATIONS!

## What is cladding?

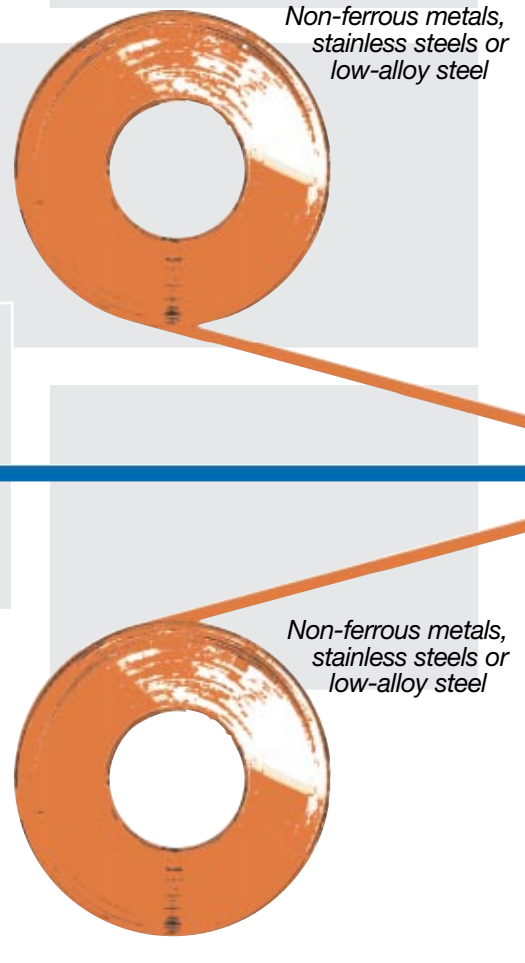


Clad strip is a composite metal consisting of different metallic layers. Metallic layers of varying thicknesses can be clad together.

During the cladding process the surfaces of the metal strips including the core strip are pre-treated and then brought together in the rolls of the cladding stand. Under high pressure the individual strips are compressed forming a (metallurgical) bond between the contact surfaces (also known as a continuous friction pressure weld).

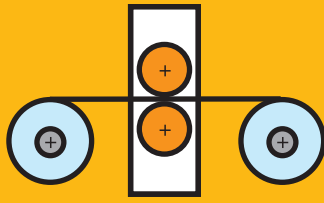
Subsequent heat treatment ensures that the layers become inseparable (through diffusion welding) and any strain-hardening caused during forming is eliminated through recrystallization.

Rolling and skin-passing steps integrated into the production process set exact size and surface requirements, which geometrically and visually satisfy the most exacting requirements.

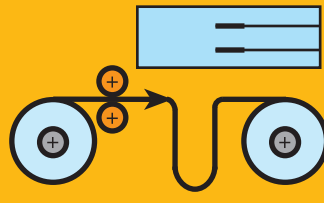




annealing



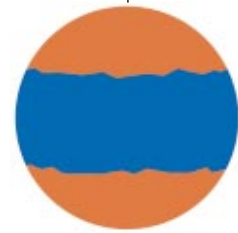
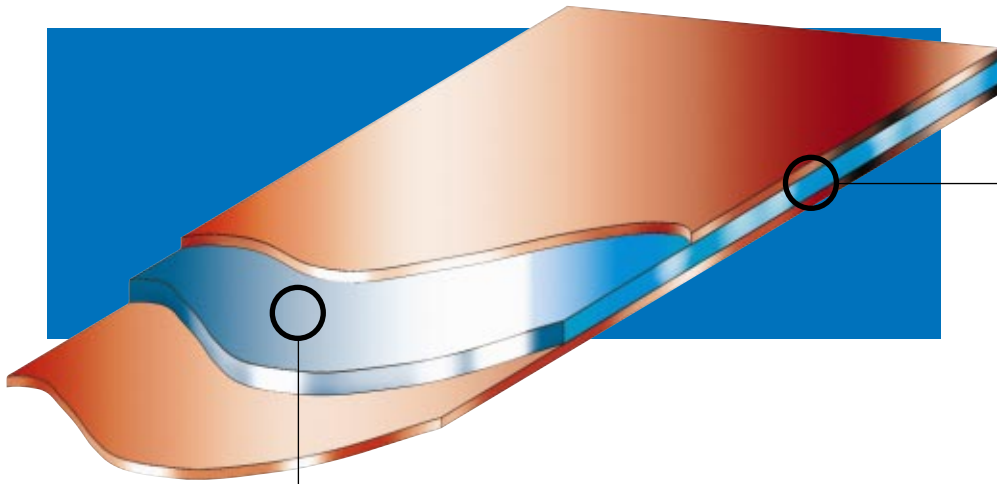
skin passing



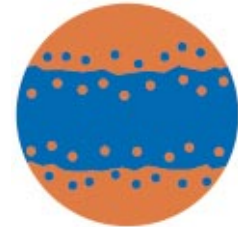
slitting



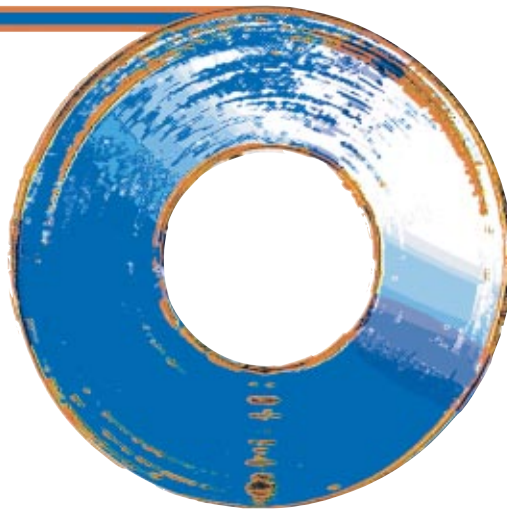
packing



**before** annealing:  
Metallurgical bond



**after** annealing:  
Diffusion welded

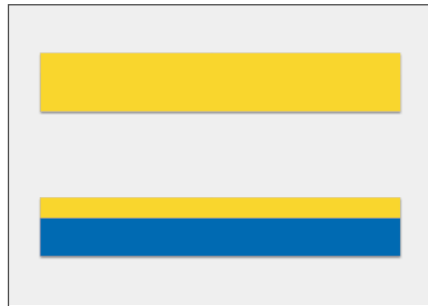


# Why cladding?

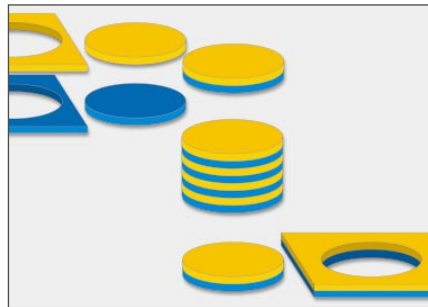


Properties can be achieved which are not available in the single material, which can be “made to order” an engineered design of composite combinations

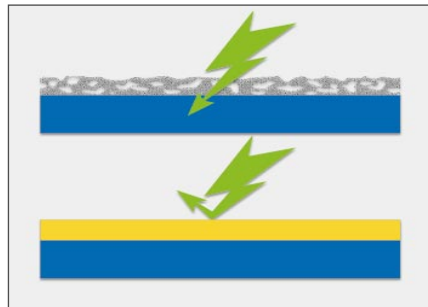
## Substitution of cost-intensive material



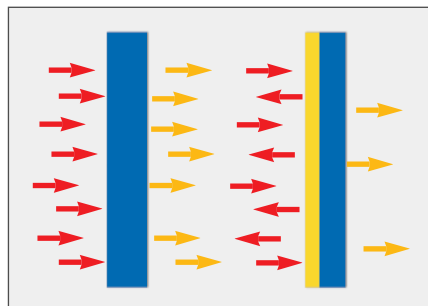
## Self-brazing clad material instead of filler material



## Solid layers instead of porous coating



## Improved reflection properties at high temperatures



## Mechanical/physical properties

- Elongation
- Tensile/Yield Strength
- Thermal expansion
- Thermal conductivity
- Specific weight
- Heat reflection capacity
- Magnetism
- Friction values

## Chemical properties

- Corrosion resistance
- Catalyst

## Electrical properties

- Electrical conductivity
- Electrical resistance
- Contact properties

## Working properties

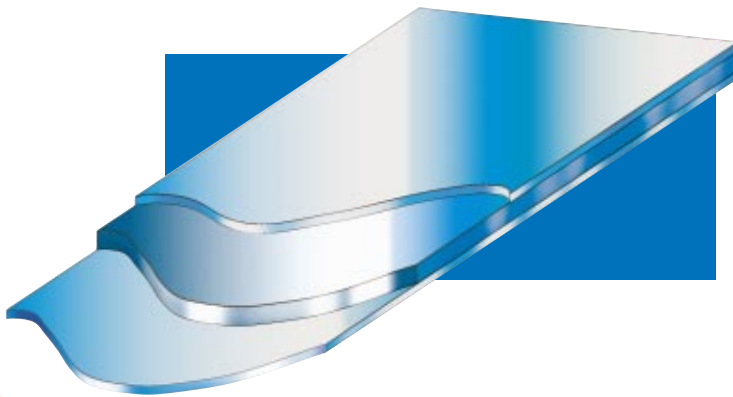
- Forming capacity
- Deep drawing properties
- Weldability, thermal capacity

## Aesthetic properties

- Appearance
- Reflectivity

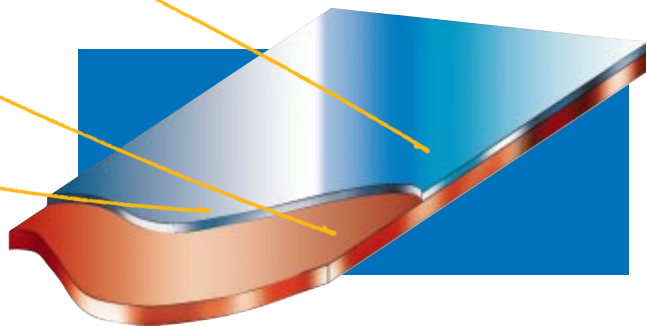
## Economical properties

- Costs
- Material availability



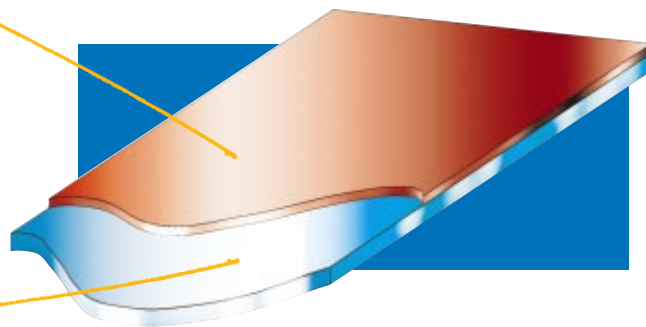
● **Example clad steel:**

FERAN® (both sides aluminium clad steel). High tensile strength, good forming property and low cost of the steel is combined with the properties of the aluminium layers to form the composite metal. These properties include corrosion resistance, oxidation resistance, electrical conductivity, good heat conductivity or heat reflection and decorative appearance. These advantages are already recognized by the automobile industry and are used in a variety of applications.



● **Example clad stainless steel:**

Cu-stainless (90% copper-layer, 10% stainless steel layer) The corrosion resistance, tensile strength and food contact safety aspect of stainless steel is combined with the good heat conductivity of copper to form the composite metal. The benefits are used e.g. in cookware.



● **Example non-ferrous metal clad:**

Al-Cu (thin copper on a aluminium core) The low specific weight, high heat conductivity, good corrosion and oxidation resistance, as well as the low cost of aluminium, is combined with the excellent electrical and heat conductivity property of copper. Electronic contacts is just one example where these properties are required.

## Clad steel

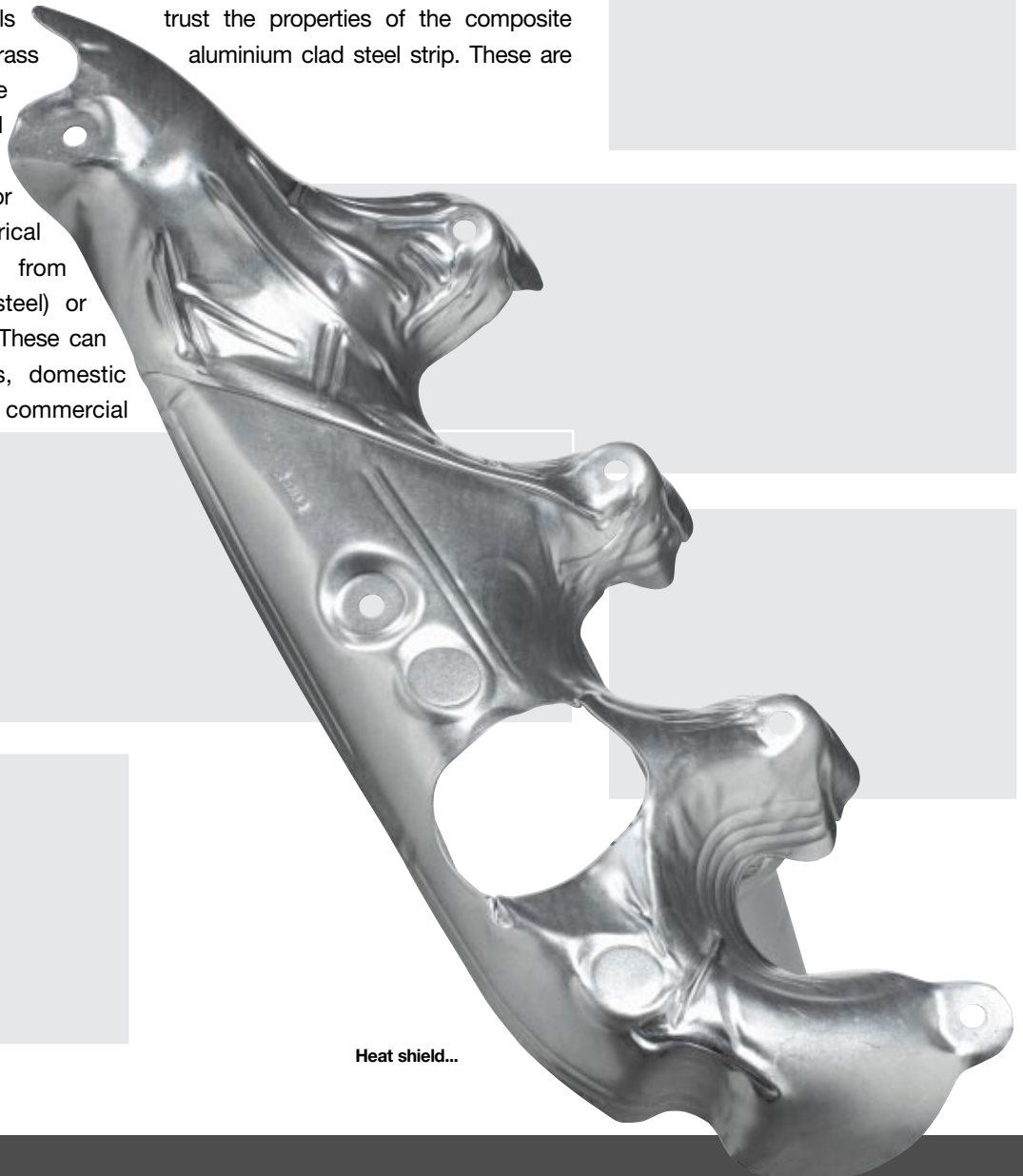


Have you ever heard of clad materials? May be not but nearly every day all of us come into contact with “smart combinations” of clad materials from Wickeder Westfalenstahl.

Well-known products, including ball-bearings, coins and medals are made from BRAFER (brass on steel), BRONFER (bronze on steel) or TOMFER (red brass on steel). Cylinder head gaskets and radiator frames and many electrical contact parts are made from FERAN® (aluminium on steel) or CUFER (copper on steel). These can be found in automobiles, domestic appliances, home and commercial electronic systems.

FERAN® is used to produce parts for muffler systems, heat shields, cylinder head gaskets and fasteners for automobiles. Also for air-conditioning systems and heating units, microwave ovens and barbecues manufacturers trust the properties of the composite aluminium clad steel strip. These are

only a few examples, where composite strip materials with a steel core developed by our engineers fulfil important functions in your everyday activities, where non-clad materials would be unsuitable.



Heat shield...



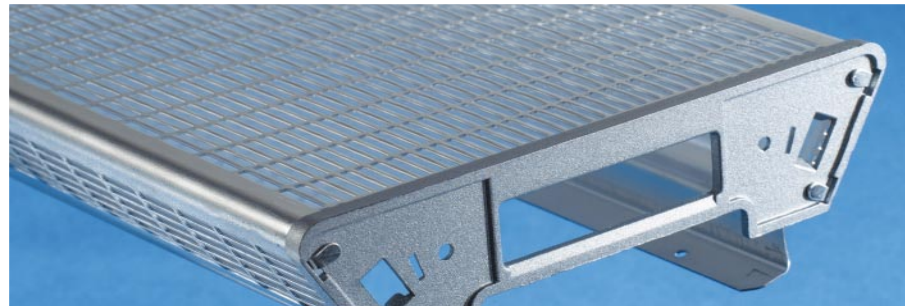
Cylinder head gaskets ...



Carbon brush/brush holder...



Hose clamps ...



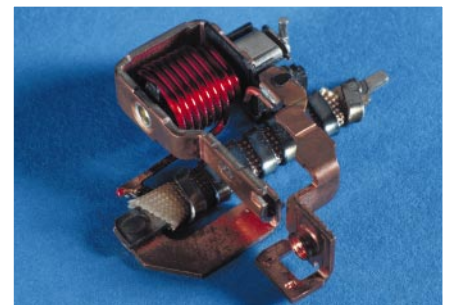
Housing ...



Heat shields ...



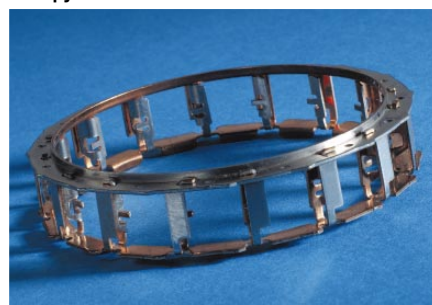
Canopy ...



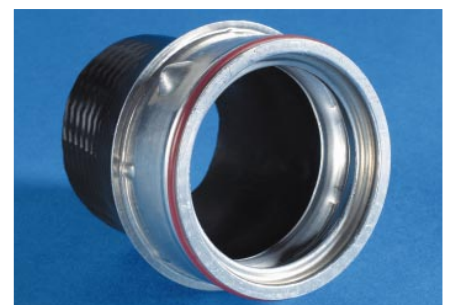
Electrical contacts ...



Reflector plates ...



Bearing housing...



Hose coupling ...

## Clad stainless steel



Clad stainless steel (Cu-stainless, stainless-Cu, Cu-stainless-Cu and Al-stainless) produced by Wickeder Westfalenstahl is mainly used in the electronics industry for heating and air-conditioning devices, as well as for domestic appliances. We cannot imagine life without these clad steel variants in the manufacturing of heat exchangers, electrical contact parts or cookware. Stainless Steel with non-ferrous metal layers combine all the specific properties of corrosion-resistant steels with the advantage of the of non-ferrous metals characteristics.

TRIMETAL, the roll-clad composite of copper, stainless and nickel, was developed especially for button cell batteries, meeting the highest surface finish, forming and chemical compatibility demands.



Button cells ...



Heat exchangers ...



Cookware ...



Button cells ...

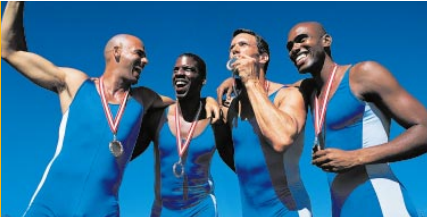


Oil cooler ...



Bimetals ...

## Non-ferrous metal clad materials



Wickeder Westfalenstahl not only combines Steel materials, but also 'fuses' non-ferrous materials or other metal alloys, such as titanium, nickel, copper, aluminium and brass, to customers' individual requirements and specific applications.

Almost daily, you will come into contact with our non-ferrous metal claddings, for example the Euro coin. Being "forgery-proof" and decorative in appearance are the most outstanding characteristics of this clad material.

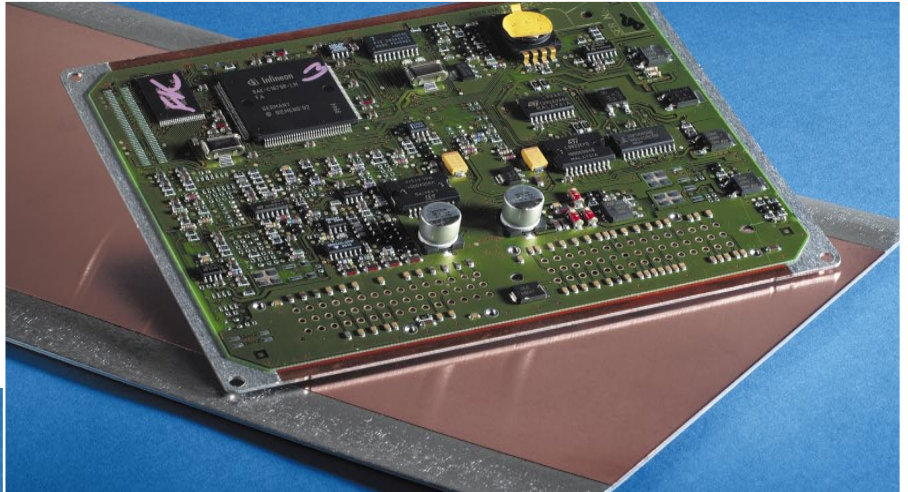
Coin operated machines recognize the defined physical appearance of the clad composite. The decorative surface accentuates the stamped image of the coin while underlining its value and the core strip is responsible for the tensile strength and magnetic properties of the coin. Once again, in the field of special claddings "smart combinations" are applied.

A further example is Al-Cu, an economically beneficial alternative to pure copper. Due to the low specific weight price advantages can be achieved when compared to pure copper. Al-Cu has high specific heat conductivity, very good electrical conductivity and high forming potential. These properties and our state-of-the art technology make it

possible to work to the tightest tolerances, which makes Al-Cu the material of choice in the electrical engineering industry.



Coins...



Card cage ...



Busbars ...



Cookware...



With state of the art technology and years of experience in metal cladding, Wickeder Westfalenstahl produces and develops cladding solutions for all industries. Wickeder Westfalenstahl produce and unrivalled range of roll-clad composites both in quality and variety.

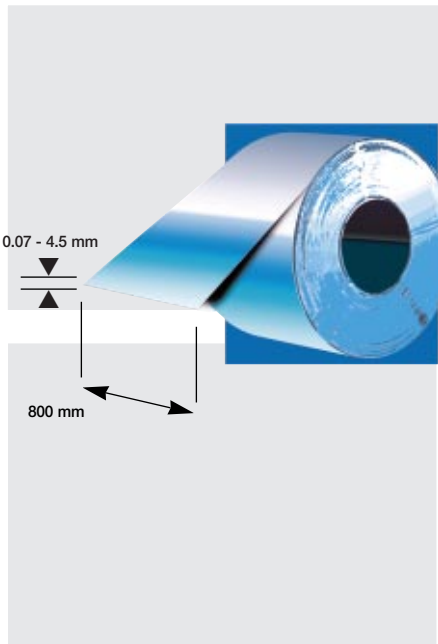
No other mill can offer you a comparable size and material spectrum. Dependant on material combination we can produce in widths up to 800 mm.

An important advantage compared to other cladding techniques is the variety and ratio of layer thicknesses.

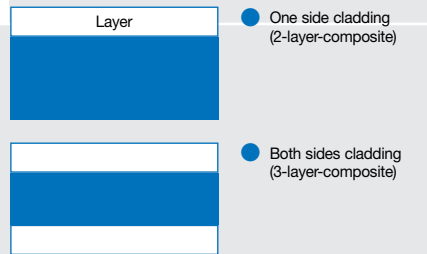
The layer thickness of each material can be equal or different from each other. The same is true for three layer material (trimetal) where all three materials may be different and different ratios. This is determined by you and the application.

However, should you not find the material combination you are looking for or the required ratio thickness – challenge us! As your innovative partner we will develop, for you and with you, “smart combinations” of material solutions.

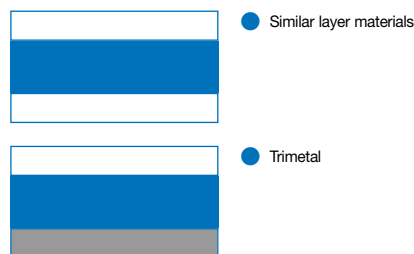
## Dimensions



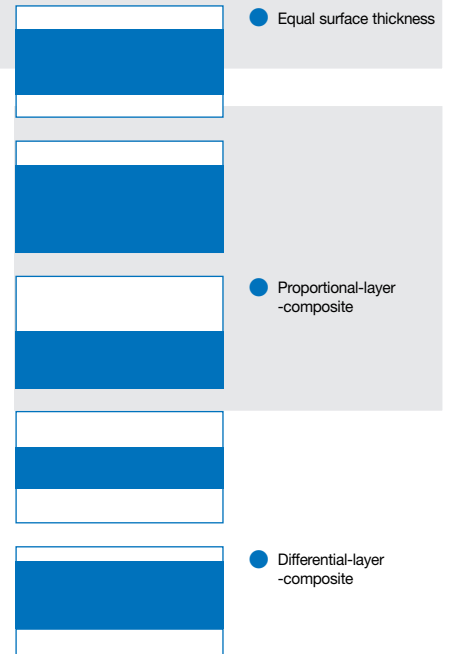
## Clad options



## Material Combinations



## Overlay options



How can we arrange "smart combinations" for you?



## CLADDING ON STEEL

	FERAN®		CUFER		BRAFER	
	aluminium	aluminium	copper	copper	brass	brass
	mild steel	mild steel	mild steel	mild steel	mild steel	mild steel
	aluminium		copper		brass	
Strip-width in mm	20-800	20-800	20-600	20-600	20-600	20-600
Strip-thickness in mm	0.07-3.5	0.07-3.5	0.3-2.5	0.3-2.5	0.3-2.5	0.3-2.5
Layers (in % of strip thickness)	20 µm-10%	20 µm-10%	3%-10%	3%-10%	3%-10%	3%-10%
Core strip grade	DC01 (unkilled)	DC01 (unkilled)	DC04 (or others)	DC04 (or others)	DC04 (or others)	DC04 (or others)
Coating strip grade	AlSi0,8	AlSi0,8	SF-Cu, SE-Cu, E-Cu, OFHC-Cu	SF-Cu, SE-Cu, E-Cu, OFHC-Cu	CuZn37	CuZn37

	TOMFER		NIFER		BRONFER	
	red brass	red brass	nickel	nickel	bronze	bronze
	mild steel	mild steel	mild steel	mild steel	mild steel	mild steel
	red brass		nickel		bronze	
Strip-width in mm	20-600	20-600	20-600	20-600	20-450	20-450
Strip-thickness in mm	0.3-2.5	0.3-2.5	0.3-1.5	0.3-1.5	0.3-1.5	0.3-1.5
Layers (in % of strip thickness)	3%-10%	3%-10%	2%-8%	2%-8%	5%-15%	5%-15%
Core strip grade	DC04 (or others)	DC04 (or others)	DC04 (or others)	DC04 (or others)	DC04 (or others)	DC04 (or others)
Coating strip grade	CuZn25, CuZn10	CuZn25, CuZn10	Ni 99,2, Ni 99,6	Ni 99,2, Ni 99,6	CuSn6	CuSn6

## CLADDING ON STAINLESS STEEL

	CU-stainless steel-CU	stainless steel-CU	CU-stainless steel	stainless steel-NI	AL-stainless steel
	copper	copper	stainless steel	nickel	stainless steel
	stainless steel	stainless steel	copper	stainless steel	aluminium, AlMg alloy
	copper				
Strip-width in mm	20-500	20-500	20-500	20-400	20-600
Strip-thickness in mm	0.3-1.0	0.3-1.5	0.10-2.5	0.12-0.8	0.8-2.5
Layers (in % of strip thickness)	3%-10%	5%-10%	10%	3%-6%	5%-20%
Core strip grade	1.4301, 1.4306, 1.4016, 1.4512, 1.4401, 1.4404 (or others)	1.4301, 1.4306, 1.4016, 1.4512, 1.4401, 1.4404 (or others)	Cu Special grade	1.4016, 1.4301	Al 99,0 Al 99,5 Al 99,8 (or others)
Coating strip grade	SF-Cu	SF-Cu, Cu Special grade	1.4301	Ni 99,6	1.4301, 1.4016, (or others)

## NON-FERROUS-METAL CLAD MATERIALS

	AL-CU	CU-AL	COIN STRIP		TRIMETALL	
	copper	Al, AlMg alloy	CuZn20Ni5	CuNi25	copper	copper
	aluminium	copper	nickel	nickel	mild steel	stainless steel
			CuZn20Ni5	CuNi25	nickel	nickel
Strip-width in mm	20-500	20-500	20-300	20-300	12-400	12-400
Strip-thickness in mm	0.3-2	0.3-2	1-1.5	1-1.5	0.12-0.8	0.12-0.8
Layers (in % of strip thickness)	10%-20%	5%-20%	44%	46,5%	Cu: 5%-15% Ni: 3%-5%	Cu: 5%-15% Ni: 3%-5%
Core strip grade	Al 99,0 Al 99,5	SF-Cu (or others)	Ni 99,2	Ni 99,2	DC04 (or others)	1.4301 (or others)
Coating strip grade	E-Cu	Al 99,5 AlMnCu	CuZn20Ni5	CuNi25	Cu: OFHC-Cu Ni: Ni 99,6	Cu: OFHC-Cu Ni: Ni 99,6

- Edge finish, thickness tolerances, straightness, strip flatness to DIN 1544 (EN 10140)
- Mill finish, roll brightened, matt finish, brushed, satin finish



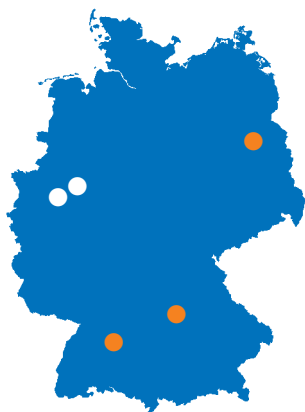
Think global – act local. “In touch with Customers” is a maxim that Wickeder Westfalenstahl has achieved through a world-wide network of subsidiaries and representatives.

## Germany

- Wickede (head office, mill I+III)
- Hagen (mill II)
- Berlin
- Schwabach
- Backnang

## Europe

- Scandinavia
- Great Britain
- Benelux countries
- Austria
- Italy
- France
- Spain

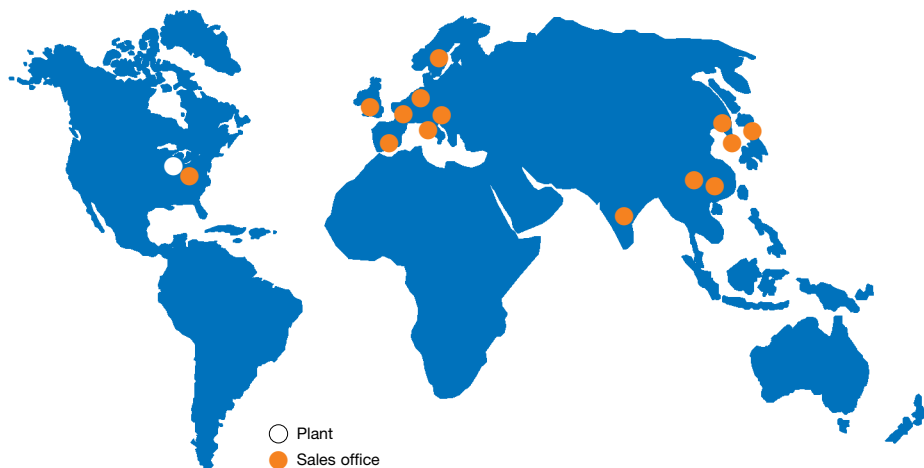


## America

- USA (Detroit)
- USA (mill IV: Wickeder Steel Company, Wisconsin)

## Asia

- Corea
- China
- Japan
- India



○ Plant  
● Sales office

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