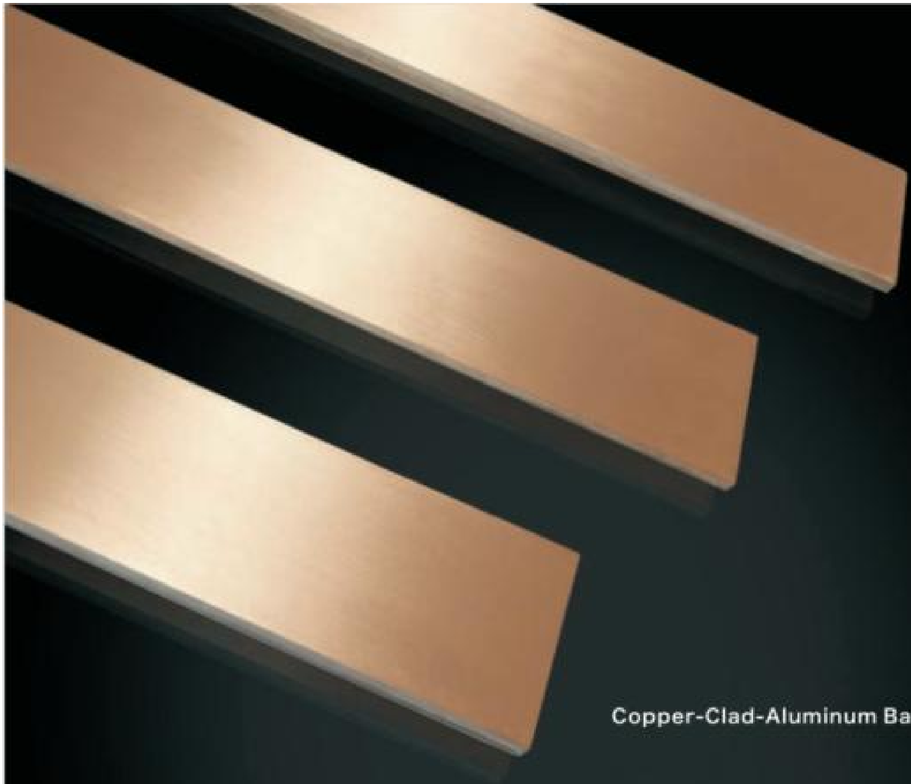


Copper-Clad-Aluminum Bar

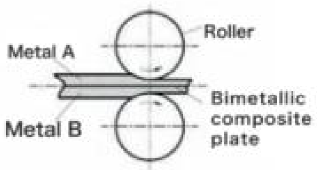
We employ a unique cast-rolling composite forming technology, which simultaneously introduces a copper strip into the liquid aluminum during its transition from liquid to solid phase. Through high temperature and pressure rolling, the atomic layers of the two metals inter-diffuse to form a crystalline bond at the interface. Subsequently, the material is cold-rolled and annealed to create a copper-aluminum composite material with a distinctive manufacturing process.

Composite Layer Thickness Ratios:	Bi-Layer Copper-Aluminum Bar Arrangement	Single-Layer Copper-Aluminum Bar Arrangement
	- (5-20%) Copper	- (5-40%) Copper
	- (90-60%) Aluminum	- (95-60%) Aluminum
	- (5-20%) Copper	

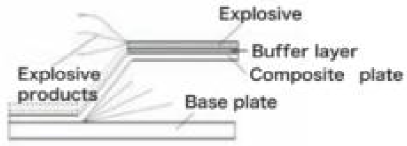
Upgrade the Q-side

The pure copper bar in the power distribution cabinets and busbar trunking is round edge, our CCA bar has also upgraded the Q edge process. The round edge is squeezed by cold extrusion, which also makes it more fit with the heat shrink insulation material, easier to electroplate also more beautiful appearance.

Traditional process of copper-aluminum composite

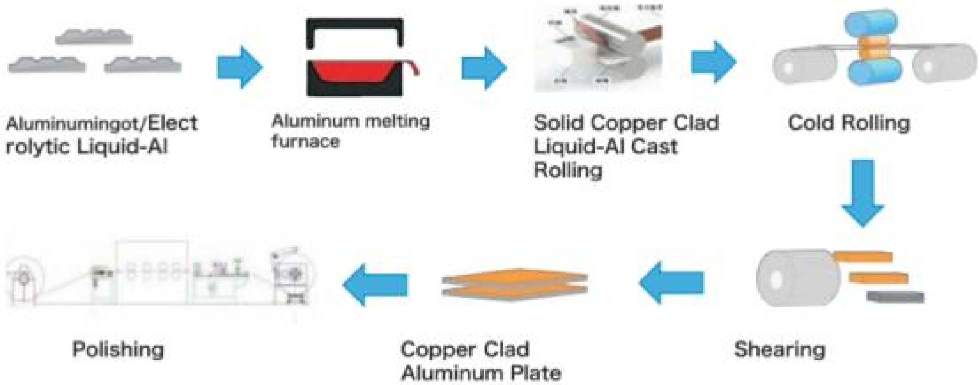


The rolling compound method: the main principle is that under the pressure of the rolling mill, the composite metal undergoes significant plastic deformation, achieving mutual contact and interlocking of the fresh surfaces of the metals to be bonded. Subsequently, an annealing treatment is applied to promote inter-diffusion between the two metals, resulting in a metallurgical bond. The interfacial bonding strength of the composite plate is relatively low.



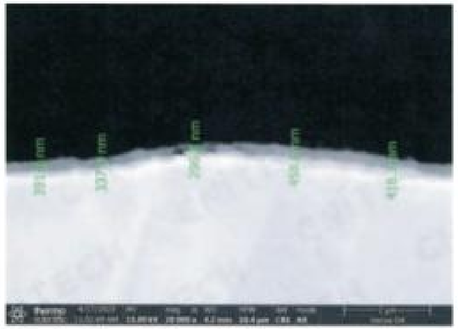
Explosion cladding is a method that utilizes the immense impact force generated by the detonation of explosives to cause the metals to be joined to collide, undergo plastic deformation, and achieve interfacial bonding. The thickness of the composite plate is greatly limited, and the process is associated with high noise, significant danger, and other issues.

Advantages of our company's copper-clad-aluminum cast rolling process: By the existing advantages in the production of aluminum sheets, and employing a unique solid-liquid cast-rolling composite technology, our products offer a revolutionary upgrade in properties such as peeling, tensile strength, shear strength, current carrying capacity, and conductivity compared to traditional copper-aluminum composite bars.



Copper-Clad-Aluminum Bar

- Tensile strength: 140-190 MPa
- Peeling strength > 80-220 N/mm
- Shear strength > 63.6 N/mm
- Elongation > 15%
- No cracks after 90° bending
- DC Resistivity ≤ 0.02350 Ωmm2/m
- Eutectic layer thickness: 300-500 nm



Interface Morphology of T2 Copper-1060 Aluminum Composite Plate

Our Copper-Clad-Aluminum bars have an average interface layer thickness of 380 nm, with the eutectic layer material being Al_2Cu and Al_4Cu_9. This not only achieves a metallurgical bond between copper and aluminum but also effectively ensures the bonding strength between them, solving the issue of high resistivity in the transitional layer. The comprehensive performance is excellent, avoiding the burrs, delamination, and flaking phenomena that occur in traditional copper-clad aluminum strips during bending, drilling, and punching processes.

Technical Benchmarking

	Industry Standards 、National Standards	Chima 's products
Products	Copper-clad Aluminum Strip	Copper-Aluminum Eutectic Strip
Tensile Strength (20% copper)	⩾110MPa	140-190MPa
Peeling Strength	> 12 N/mm	> 80-220 N/mm
Shear Strength	> 35 N/mm	> 63.6 N/mm
Bending	No cracks, bubble .	No cracks after 90° bending
20℃ DC Resistivity	⩽ 0.02606 Ωmm2/m	⩽ 0.02350 Ωmm2/m
Elongation	⩾11%	> 15%

The various indicators of our CCA Bar are superior to both industry and national standards, with the peel strength exceeding the national standard by more than ten times.

Company laboratory

Recommended bar sizes compared between CCA and Copper T2

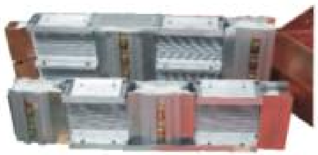
Current ampacity of commonly used rectangular busbar（Busbar size for low voltage power cabinet）

No.	Busbar size		Maximum ampacity of copper busbar Continuous Current（A） Environment Temp. 40℃	M. W. (KG) Density 8.9	Copper Clad Aluminum Continuous Current (A) Temp. 40℃					
					Recommended size (1)			Recommended size (2)		
	W	T			W	T	M.W.	W	T	M.W.
1	10	3	≤63	0.267	10	3.3	0.130	11	3	0.130
2	15	3	170	0.401	15	3.3	0.195	16.5	3	0.195
3	20	3	220	0.534	20	3.3	0.260	22	3	0.260
4	25	3	276	0.668	25	3.3	0.325	27.5	3	0.325
5	30	3	325	0.801	30	3.3	0.390	33	3	0.390
6	40	3	410	1.068	40	3.3	0.520	44	3	0.520
7	25	4	325	0.890	25	4.5	0.445	27.5	4	0.433
8	30	4	385	1.068	30	4.5	0.534	33	4	0.520
9	40	4	510	1.424	40	4.5	0.712	44	4	0.693
10	50	4	600	1.780	50	4.5	0.890	55	4	0.867
11	20	5	325	0.890	20	5.8	0.453	22	5	0.433
12	25	5	360	1.113	25	5.8	0.566	27.5	5	0.542
13	30	5	430	1.335	30	5.8	0.680	33	5	0.650
14	40	5	570	1.780	40	5.8	0.906	44	5	0.867
15	50	5	700	2.225	50	5.8	1.133	55	5	1.084
16	60	5	820	2.670	60	5.8	1.359	66	5	1.300
17	80	5	1080	3.560	80	5.8	1.812	88	5	1.734
18	100	5	1350	4.450	100	5.8	2.266	110	5	2.167
19	25	6	415	1.335	25	6.9	0.680	27.5	6	0.650
20	30	6	490	1.602	30	6.9	0.816	33	6	0.780
21	40	6	630	2.136	40	6.9	1.087	44	6	1.040
22	50	6	774	2.670	50	6.9	1.359	55	6	1.300
23	60	6	912	3.204	60	6.9	1.631	66	6	1.560
24	80	6	1200	4.272	80	6.9	2.175	88	6	2.080
25	100	6	1470	5.340	100	6.9	2.719	110	6	2.600
26	120	6	1740	6.408	120	6.9	3.262	132	6	3.120
27	30	8	565	2.136	30	9.2	1.087	33	8	1.040
28	40	8	720	2.848	40	9.2	1.450	44	8	1.387
29	50	8	920	3.560	50	9.2	1.812	55	8	1.734
30	60	8	1070	4.272	60	9.2	2.175	66	8	2.080
31	80	8	1370	5.696	80	9.2	2.900	88	8	2.774
32	100	8	1685	7.120	100	9.2	3.625	110	8	3.467
34	120	8	1945	8.544	120	9.2	4.350	132	8	4.161
35	25	10	520	2.225	25	11.5	1.133	27.5	10	1.084
36	30	10	720	2.670	30	11.5	1.359	33	10	1.300
37	40	10	920	3.560	40	11.5	1.812	44	10	1.734
38	50	10	1000	4.450	50	11.5	2.266	55	10	2.167
39	60	10	1195	5.340	60	11.5	2.719	66	10	2.600
40	80	10	1540	7.120	80	11.5	3.625	88	10	3.467
41	100	10	1870	8.900	100	11.5	4.531	110	10	4.334
42	120	10	2170	10.680	120	11.5	5.437	132	10	5.201
43	125	10	2170	11.125	125	11.5	5.664	137.5	10	5.418
44	30	12	615	3.204	30	13.8	1.631	33	12	1.560
45	40	12	820	4.272	40	13.8	2.175	44	12	2.080
46	50	12	1025	5.340	50	13.8	2.719	55	12	2.600
47	60	12	1230	6.408	60	13.8	3.262	66	12	3.120
48	80	12	1640	8.544	80	13.8	4.350	88	12	4.161
49	100	12	2050	10.680	100	13.8	5.437	110	12	5.201
50	120	12	2460	12.816	120	13.8	6.525	132	12	6.241
51	125	12	2562.5	13.350	125	13.8	6.797	137.5	12	6.501

Busbar

The CCA busbar produced by Chima has resolved the requirements for lightweight and cost reduction for busbar trunking customers in practical applications due to its excellent current carrying capacity performance and cost-effectiveness.



Additionally, the lightweight nature also facilitates convenience and cost reduction in installation and transportation.

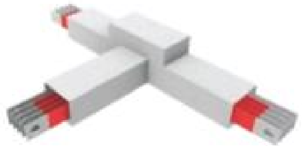
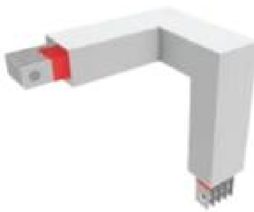



It has changed the inconvenience of welding that was required when using copper busbars for right-angle bends, fillet bends, and plug-in terminals. Now, it is possible to supply the busbar cut to the customer's drawings from the entire plate, which not only enhances the reliability at the connection points but also saves on labor costs.







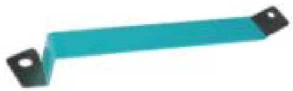




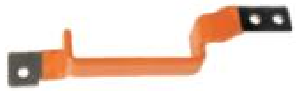
Power Distribution Cabinets

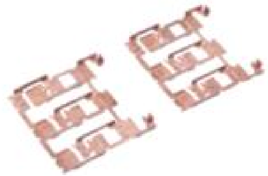
Our CCA bars has been widely used in switch gear and transformers due to its current carrying capacity and temperature rise being essentially equivalent to that of copper busbars, its high peeling strength, and excellent mechanical processing performance in bending and punching.

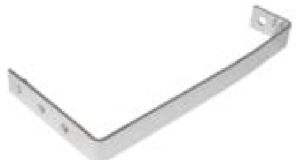
Accessories

Our CCA material, is available in wide widths up to 800mm and in thicknesses ranging from 14mm to 0.5mm. This facilitates the processing of special-shaped parts, making it a new favorite for replacing copper components in applications such as molded-case circuit breakers, knife switches, photovoltaic junction boxes, terminal boards, and charging pile connection bars.





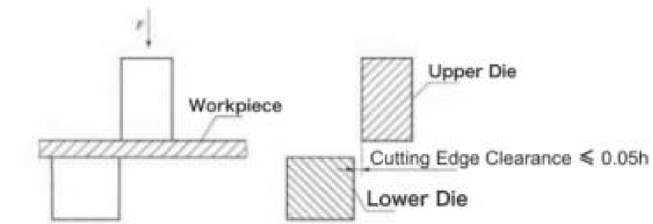




CCA Bar Processing Requirements

Punching

In the punching process, it is necessary to adjust the mold clearance properly. The clearance between the cutting edges should not exceed 0.05h, and the cutting edges should be sharp. The clearance fit is shown in the following pictures.

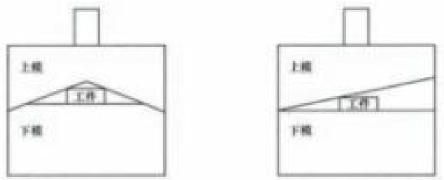


F - Punching Force

h - Product Thickness

Clearance Fit Parameters

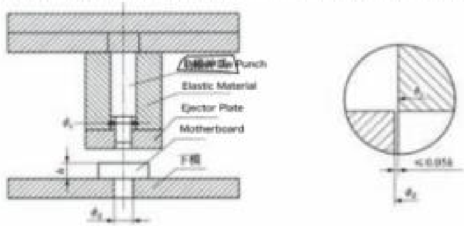
The following pictures show punching methods that are not allowed.



Hole Processing Methods

Hole Punching

The punch mold clearance should meet the requirements that the single-sided clearance of the punch and the die should not exceed 0.05h, as is shown in the following pictures.



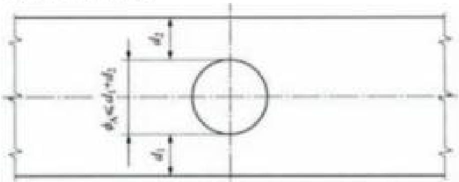
Øc - Punch Diameter

Ød - Die Diameter

h - Product Thickness

Punching Parameters

The punch diameter ØA should be selected to meet the condition ØA ≤ d1 + d2. The punch should have an ejector plate, as is shown in the following picture.



The upper mold should have an ejector plate, which can be referred to in the following picture.

If the upper mold does not have an ejector plate, it will cause the bonding layer to be damaged, as shown in the above photo.

When designing the position of the piercing hole from the end surface, it should be ensured that the distance δ ≥ h (h is the product thickness); when using a rivet nut, the bottom hole of the stamping should ensure δ ≥ h + 5mm (h is the product thickness), which is demonstrated in the following picture.

Piercing Position Requirements Schematic

Drilling

When drilling, it is important to ensure that the drill bit is sharp. When the drill bit approaches the bottom surface of the copper layer, the feed rate should be appropriately slowed down, and a pad should be installed underneath.

Bending

Vertical Bending (Wide Edge Bending)

The bending radius in the thickness direction for vertical bending to a 90-degree angle can refer to Table 1.1.

Table 1.1 Bending Radius for CCA Busbars

Nominal Size (Product Thickness) h mm	Recommended Bending Radius mm
≤5	h
6	6, 8, 10
8	8, 10, 15
10	10, 12, 15
12	15, 20

When the bending radius does not meet the standard, problems such as copper layer splitting and wrinkling are prone to occur, as shown in the picture.

Lateral Bending (Narrow Edge Bending)

The bending radius value R should be greater than Zb (where b is the product width). The use of lateral bending should be discussed with the processing company to utilize existing molds.

Bending Design

During the design process, it should be ensured that the straight line segment on both sides of the bending is not less than 0.5t + 0.5R. Special cases can be customized by negotiating with the mold manufacturer.

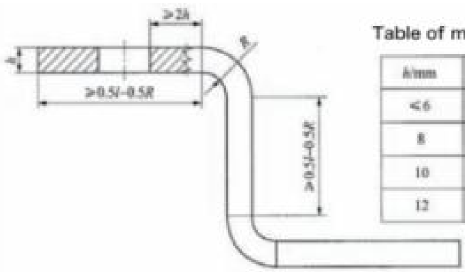
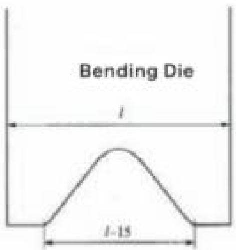


Table of mold parameter

h/mm	l/mm
≤6	60
8	85
10	90
12	120



Description:

h - Product thickness, mm.

R - Bending radius, mm.

l - Bending die width, mm.

CCA busbars Bolt Connection Requirements

1 Contact Surface

The contact surfaces between bolt connections should be kept clean and coated with electrical composite grease as required by the demander.

2 Installation

2.1 When CCA busbars are laid flat, bolts should be threaded from bottom to top, with nuts on the top; in other cases, nuts should be placed on the maintenance side, and the bolt length should be protruding 2 to 3 threads from the nut.

2.2 There should be a flat washer between the bolt and the CCA busbar tightening surface. When multiple bolts connect the copper-aluminum composite busbar, there should be a clear distance of more than 3.0 mm between adjacent bolts, and a spring washer or lock nut should be installed on the nut side.

2.3 The contact surfaces of the CCA busbar should be tightly connected, and the connecting bolts should be tightened with a torque wrench. The torque value for steel bolts should comply with the provisions of Table 1, and the torque value for non-steel bolts should meet the product technical requirements.

Table 1 Steel Bolt Tightening Torque Values

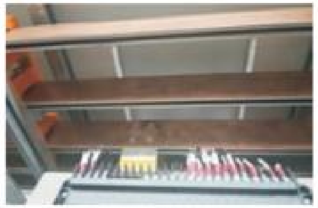
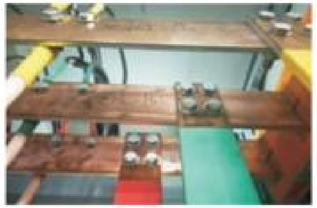
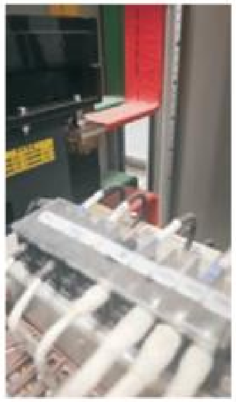
Steel Bolt Tightening Torque Value

Bolt Specification mm	Torque Value NM	Washer Nominal Value mm	Outside Diameter mm	Thickness mm	Busbar Width Used
M8	8.8-10.8	8	24	2	0-60
M10	17.7-22.6	10	30	2.5	60-80
M12	31.4-39.2	12	37	3	60-100
M14	51-60.8	14	44	3	100-120
M16	78.5-96.1	16	50	3	100-140
M20	56.9-196.2	20	60	4	125-160
M24	74.6-343.2	24	72	5	160-200
Note: Washer parameters are derived from GB/T96.1 large washers Grade A. For busbars with a width of 60mm and above, it is recommended to use large washers or tile washers; for busbars with a width of 50mm and below, it is recommended to use ordinary flat washers.					

Site And Tooling

Main Equipment

Application





Test Report

Experimental Process:

After the sample is embedded, it undergoes grinding and polishing processes. AgCl is used as the reference electrode, Pt as the counter electrode, and the sample as the working electrode. Once assembled, it is connected to the GARMRY electrochemical workstation for electrochemical corrosion experiments. First, the open-circuit potential is tested to obtain the open-circuit potential data. After obtaining the data, an electrochemical test program corresponding to each sample is set up to test its OCP (open-circuit potential), EIS (electrochemical impedance spectroscopy) data, and dynamic polarization curve. The electrochemical data such as corrosion potential, corrosion current density, and corrosion rate are obtained.

Three different samples were tested, with three sets of electrochemical experiments conducted for each sample. The test results were fitted and analyzed to obtain the corrosion potential, corrosion current density, and corrosion rate for each sample as shown in the following table:


CNITECH

检 测 报 告

NO. 2023-10-26-BM0001

检测日期 2023.10.25

中国科学院宁波材料技术与工程研究所测试中心

Test Center, Ningbo Institute of Materials Technology & Engineering, Chinese Academy of Sciences

Sample Number	Open-Circuit Potential (V,vs Ag/AgCl)	Corrosion Current Density (A/cm^2)	Corrosion Potential (V,vs Ag/AgCl)	Corrosion Rate (mmpy)
Cu	-0.179	3.93×10^{-6}	-0.198	1.49×10^{-1}
Al	-0.695	2.37×10^{-7}	-0.713	4.58×10^{-3}
Cu-Al	-0.688	4.11×10^{-6}	-0.673	2.17×10^{-1}

Note: The corrosion rate is calculated by the Tafel fitting of the dynamic polarization curve in the analysis software, with the unit of mmpy, which stands for mm per year.

1. The galvanic corrosion rate of pure copper is around 0.15mm/year.

Interpretation: After the copper plate is combined with the aluminum plate, due to the effect of galvanic corrosion, the corrosion current density is higher, but it is still within the same order of magnitude. It can be considered that the corrosion resistance of the composite plate is comparable to that of the pure copper plate.

2. The corrosion rate of the CCA plate in seawater salinity is estimated to be 0.2mm/year.