



Copper-aluminum alloy composite flat wire live salt spray test report

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Sample Name	Copper-aluminum alloy composite flat wire	
Product Specifications	16mmX3mm	(Width x Thickness)
Material grade	T2/8030	
Test start time:	2024-07-27	
Test end time:	2024-09-24	
Test Results	Please see the next page (unless otherwise specified, this report is only responsible for the results of copper-aluminum composite flat wire).	

Yantai Fuxinda Bimetallic Co., Ltd.

Authorized Signature

Zhong Weiren

Authorized signatory

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Summary of results:

sample Serial Number	Test Project	Test methods	result	in conclusion	Remark
1	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	According to GB/T 10125, non-corrosion,	small bubbles at the end, 10/9 vs G tin-plated, charged		
2	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	According to GB/T 10125, it is non-corrosive and non-foaming.		10/10	Tin-plated, electrified
3	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240 hours	According to GB/T 10125, it is non-corrosive and non-foaming.		10/10	Tin-plated, electrified
4	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240 hours	According to GB/T 10125, it is non-corrosive and non-foaming.		10/10	Nickel plating, charged With insulation
5	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	Slight corrosion at the tip (refer to GB/T 10125)		10/9sE	Nickel plated, charged
6	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	Refer to GB/T 10125	The copper surface showed no corrosion or blistering. End corrosion	10/7sE	Nickel plating, charged With insulation
7	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	According to GB/T 10125, non-corrosion,	small bubbles at the end, 10/9 vs G tin-plated, non-electrostatic.		
8	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240 hours	Refer to GB/T 10125	Non-corrosive, end-capped 2.5mm bubble	10/8VG tin-plated, non-electrically charged	
9	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240+500 hours	Refer to GB/T 10125	The copper surface showed no corrosion or blistering. End corrosion	10/6sE	Nickel plating, non-electrolyte. With insulation
10	Copper-aluminum alloy composite flat wire salt spray Tested for 96+240 hours	Refer to GB/T 10125	The copper surface showed no corrosion or blistering. End corrosion	10/7sE nickel plating, non-electrolyte	

Note: Pass: Meets requirements

Unqualified: Does not meet requirements

/: No judgment made

A comparison of samples before and after salt spray testing reveals the following:

For products with tin plating numbers 1, 2, 3, 7, and 8, the plating layer is fully covered, and whether or not the product is powered on has little impact on its salt spray resistance.

2. The nickel-plated products numbered 4, 5, 6, 9, and 10 had incomplete plating at the ends, resulting in electrochemical corrosion at the ends of non-energized products. The aluminum, acting as the anode, was corroded.

Corrosion and wear; only one terminal (No. 6) of the electrically powered product showed corrosion, while the others did not show visible corrosion.

3. During the test, the temperature rise of the test sample was stable, meeting the requirement of temperature rise $\leq 50K$, and the temperature rise at the overlap was about 2-3K.

4. After 96 hours of testing, the sample weight did not change significantly. After 240 hours, samples 6, 7, and 8 decreased by 0.01g-0.02g, and sample 9 decreased by 0.12g.

After 500 hours, the weight loss was not significant in groups 1, 2, and 5; 0.05g was lost in groups 6 and 7; and 0.38g was lost in group 9.

5. Before and after 500 hours of salt spray, the contact resistance did not change significantly.

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Test item: Salt spray test of copper-aluminum alloy composite flat wire samples

Sample Description: Metal Part

Test method: Refer to GB/T 10125

Salt spray rating method: Refer to GB/T6461-2002

Test conditions:

Under 5% salt spray conditions and 190A DC current, samples 1-6 were connected in series and placed into the salt spray chamber, while samples 7-9 served as the control group without power.

After placing the samples in the same salt spray environment with and without power on for 96 hours, 240 hours, and 500 hours, the samples were observed, photographed, and rated, and the temperature rise was recorded data.

Salt spray test results:

Sample number, test item, test results	Rating	Remark
1 96+240+500 hours of hourly salt end test	No corrosion, small bubbling at the 10/9vsG	Tin-plated, electrified
2 96+240+500 hours of salt per hour mist test	No corrosion, no foaming 10/10	Tin-plated, electrified
3 No corrosion or bubbling was observed during the 96+240 hour salt spray test.	10/10	Tin-plated, electrified
4 No corrosion or bubbling was observed during the 96+240 hour salt spray test.	10/10	Nickel plated, charged, and insulated
5 96+240+500 hours of salt per hour at the end	slight corrosion mist test 10/9sE	Nickel plated, charged
6 96+240+500 hours of salt per hour Fog test	The copper surface is free of corrosion and blistering, and the ends are free of corrosion and blistering. corrosion 10/7sE	Nickel plated, charged, and insulated
7 96+240+500 hours of salt per hour end test	No corrosion, small bubbling at the 10/9vsG	Tin-plated, non-electrostatic
8 No corrosion was observed after 96+240 hours of salt spray testing ; 2.5mm blisters appeared at the tip.	10/8vG	Tin-plated, non-electrostatic
9 96+240+500 hours of salt per hour Fog test	The copper surface is free of corrosion and blistering, and the ends are free of corrosion and blistering. corrosion 10/6sE	Nickel-plated, non-electric, insulating
10 After 96+240 hours of salt spray testing, the copper surface showed no corrosion or blistering, and the end... corrosion	10/7sE	Nickel plated, non-electrostatic

Contact resistance test results:

	The joint between tin plating No. 1 and No. 2, and the joint between tin plating No. 2 and nickel plating No. 5.	Tin-plated overlap at No. 5 and No. 6
500h salt spray before	8 \ddot{y}	6 \ddot{y}
500h salt spray	8 \ddot{y}	7 \ddot{y}

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Weight test results:

Sample number	Salt spray Weight (g)	96h salt spray Post-weight (g)	240h salt spray Post-weight (g)	500h salt spray Post-weight (g)	500h salt spray Post-difference (g)
1	49.8879	49.8873	49.8842	49.8820	0.0059
2	49.4215	49.4213	49.4170	49.4181	0.0034
3	49.6797	49.6793	49.6750		/
4	53.7452	53.6928	53.6868	//	/
5	50.4648	50.4654	50.4635	50.4647	0.0001
6	53.6944	53.6579	53.6398	53.6348	0.0596
7	49.9358	49.9361	49.9191	49.8925	0.0433
8	49.3954	49.3957	49.3847	/	/
9	54.3638	54.3790	54.2577	53.9831	0.3807
10	49.7268	49.7006	45.4454 (cut)	/	/

Temperature rise test results: During 96h and 240h, the temperature inside the salt spray chamber was 35~36.

	No. 2 tin plating bend	Tin plating No. 2 and No. 3 Overlap	No. 3 tin plating middle	Nickel plating No. 4 Intermediate-insulated	Nickel plating No. 4 and No. 5 Overlap	Nickel plating No. 5 bend
Day 1 22.7 K		28.0 K	21.0 K	24.6 K	24.0 K	22.4 K
Day 2 22.1 K		26.2 K	20.4 K	23.2 K	22.9 K	21.0 K
Day 3 22.3 K		25.9 K	20.8 K	23.4 K	23.0 K	20.8 K
Day 4 22.8 K		26.1 K	22.1 K	23.8 K	23.2 K	20.9 K
Day 5 22.2 K		25.6 K	22.3 K	23.4 K	23.2 K	20.6 K
Day 6 23.0 K		26.0 K	23.0 K	24.0 K	24.0 K	21.0 K
Day 7 22.1 K		25.0 K	22.9 K	23.7 K	22.9 K	20.2 K
Day 8 23.0 K		25.8 K	24.0 K	24.1 K	23.6 K	20.6 K
Day 9, 22.3 K		25.0 K	23.3 K	23.9 K	23.0 K	20.1 K
Day 10 22.1 K		24.7 K	23.0 K	23.4 K	22.9 K	20.0 K
Day 11 22.3 K		24.9 K	23.0 K	23.7 K	23.0 K	20.0 K
Average 22.5 K		25.7 K	22.3 K	23.8 K	23.2 K	20.7 K

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Temperature rise test results: During the 500-hour period, the temperature inside the salt spray chamber was 35y~36y.

	No. 1 and No. 2 Tin-plated overlap	No. 2 tin plating middle	No. 2 tin and No. 5 nickel Overlap	Nickel plating No. 5 middle	No. 5 and No. 6 Tin-plated overlap
Day 12	21.0 K				
Day 13		23.6 K	25.0 K	25.0 K	27.0 K
Day 14	20.8 K	22.4 K	23.8 K	24.9 K	26.1 K
Day 15	20.4 K	22.9 K	24.0 K	25.0 K	26.9 K
Day 16					
Day 17	19.5 K	22.1 K	23.2 K	23.7 K	25.8 K
Day 18	21.0 K	21.2 K	22.7 K	23.1 K	25.1 K
Day 19					
Day 20	21.4 K	21.6 K	23.3 K	23.9 K	26.0 K
Day 21	21.3 K	21.4 K	23.1 K	23.6 K	26.0 K
Day 22	21.8 K				
Day 23	21.3 K	21.9 K	23.6 K	24.3 K	26.2 K
Day 24					
Day 25	20.7 K	21.9 K	23.7 K	24.4 K	26.2 K
Day 26	20.5 K	21.9 K	23.7 K	24.4 K	26.2 K
Day 27					
Day 28	20.9 K	21.8 K	23.6 K	24.3 K	26.2 K
Day 29	21.9 K	21.6 K	23.1 K	24.0 K	25.8 K
Day 30					
Day 31	20.3 K	21.1 K	22.7 K	23.6 K	25.0 K
Day 32	19.9 K	20.8 K	22.0 K	22.9 K	24.9 K
Day 33					
Average	19.6 K	21.1 K	22.5 K	23.5 K	25.1 K
		21.4 K	22.7 K	23.8 K	25.2 K
		21.3 K	22.9 K	23.9 K	25.6 K
		21.4 K	23.0 K	24.0 K	25.9 K
		21.2 K	22.1 K	23.1 K	24.3 K
		20.7 K	21.6 K	22.2 K	24.1 K
		20.6 K	21.3 K	22.1 K	23.9 K
		20.9 K	21.7 K	22.6 K	24.0 K
	20.8 K	21.6 K	23.0 K	23.7 K	25.5 K

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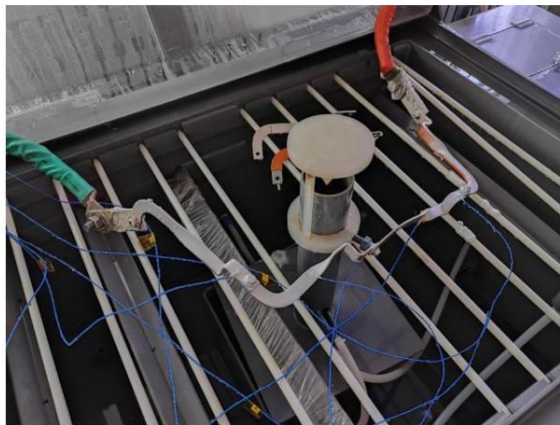
Test photos:



Photos before the experiment



Photos of the experiment process



Photos after 500 hours of salt spray



A partial photograph taken after 500 hours of salt spray (1 mm of salt deposited on the upper surface).

1				
sample	Salt spray	96 hours after salt spray	240h salt spray	500h salt spray
Serial Number				

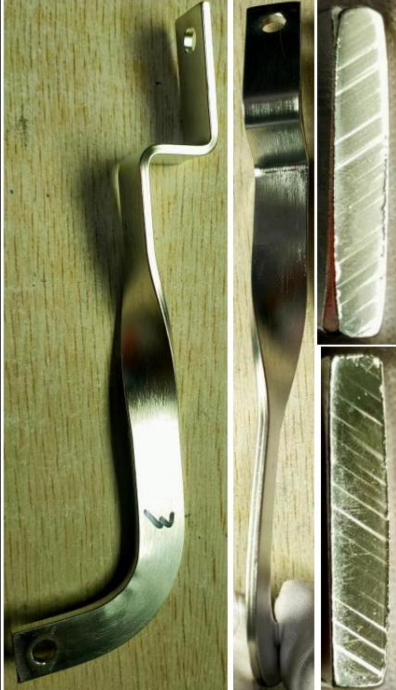


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2				
sample	Salt spray	96 hours after salt spray	240h salt spray	500h salt spray
Serial Number				

3			
sample	Salt spray	96 hours after salt spray	240h salt spray
Serial Number			

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4			
sample	Salt spray	96 hours after salt spray	240h salt spray
Serial Number			

5				
sample	Salt spray	96 hours after salt spray	240h salt spray	500h salt spray
Serial Number				

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6				
sample	Salt spray	96 hours after salt spray	240h salt spray	500h salt spray
Serial Number				

7				
sample	Salt spray	96 hours after salt spray	240h salt spray	500h salt spray
Serial Number				

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8			
	sample Serial Number	Salt spray	96 hours after salt spray

9				
	sample Serial Number	Salt spray	96 hours after salt spray	240h salt spray

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10			
			
sample	Salt spray	96 hours after salt spray	240h salt spray
Serial Number			

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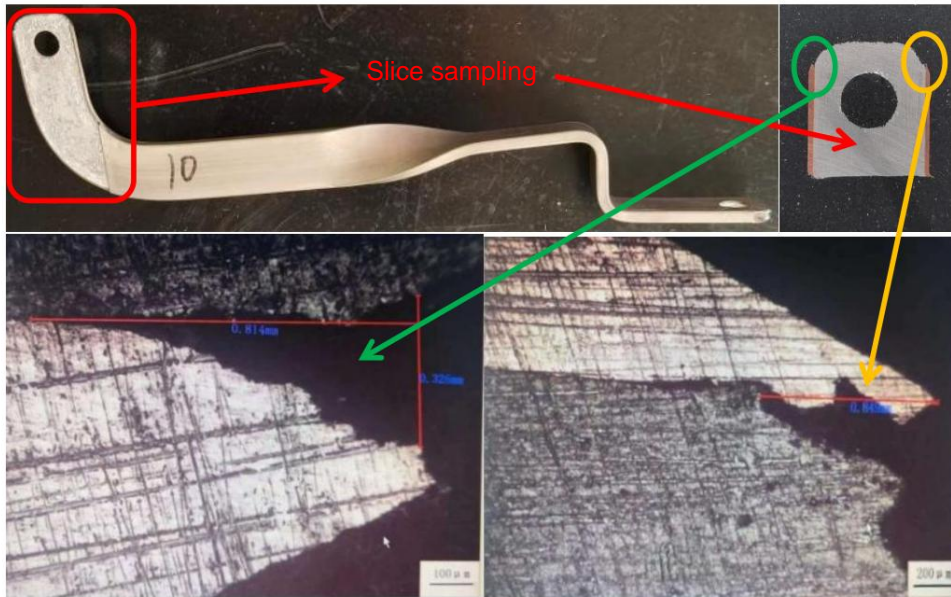
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Metallographic test results after salt spray:

1. Metallographic analysis after 220h salt spray test. Sample No. 10 is a cut sample with a nickel-plated end. After 96h + 124h = 220h, the mating end...

A stamping delamination test was conducted, and metallographic analysis was performed on a section at one end. The porosity depth between the copper and aluminum at the end was 0.814 mm to 0.849 mm, and the maximum porosity was...

0.326mm, details are as follows:

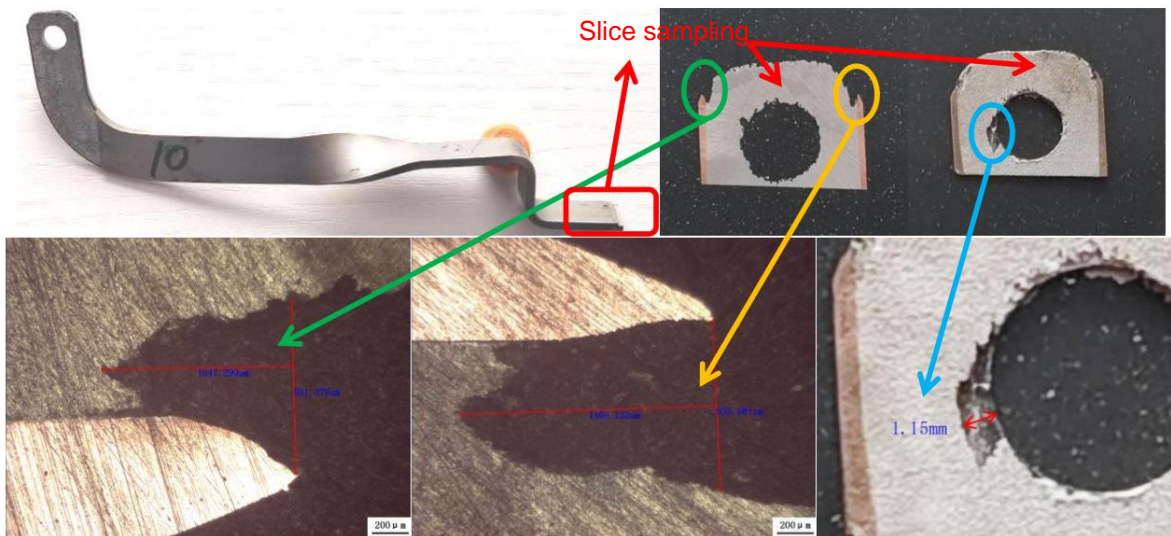


2. Metallographic examination after 336 hours of salt spray testing. Sample No. 10 was a nickel-plated end-cut sample. At 96 hours + 240 hours = 336 hours, in another...

Metallographic analysis of the end sections showed that the maximum depth of the pores between the copper and aluminum ends was within the aluminum core near the bonding layer.

The sample bore diameter is 1.05mm~1.41mm, and the pore width is 0.94mm~0.95mm; the corrosion depth of the aluminum core inside the sample bore is 1.15mm, while in actual working conditions, the bore is overlapped.

When sealed, it will not experience similar corrosion.



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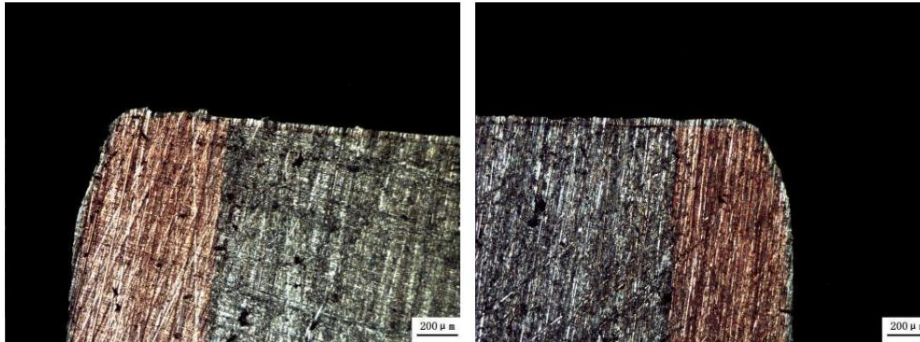
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3. Metallographic examination after 336 hours of salt spray testing. Samples No. 3, 4, and 8 were then subjected to a salt spray test for 96 hours + 240 hours = 336 hours.

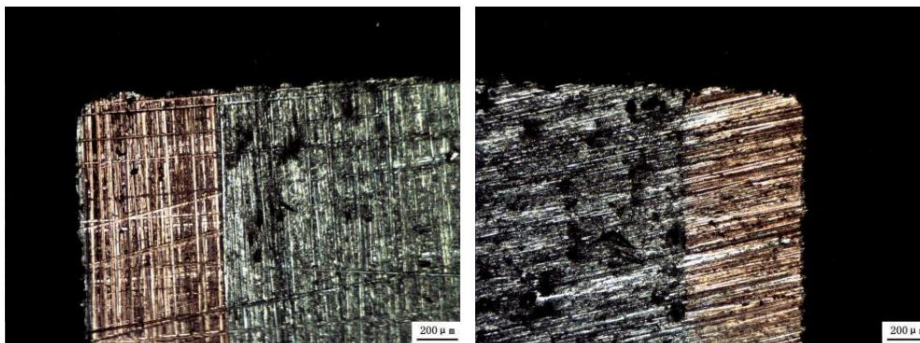
Metallographic analysis was performed on sections from both ends.



3.1 Among them, No. 3 and No. 8 are tin-plated products with full coating. The surface coating is visible and not corroded, and the substrate is protected and not corroded.



Sample No. 3



Sample No. 8

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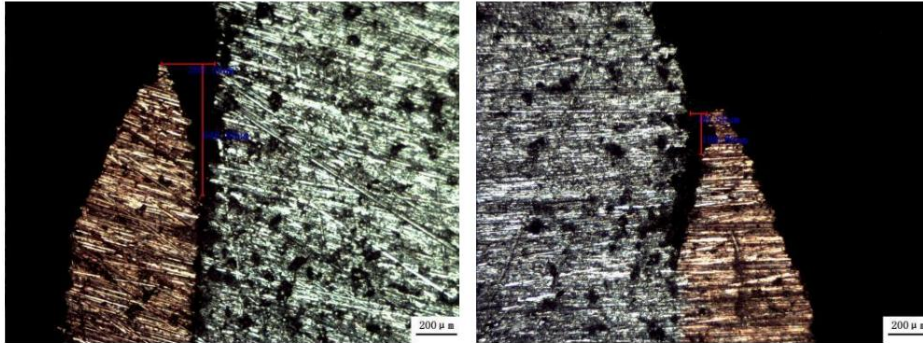
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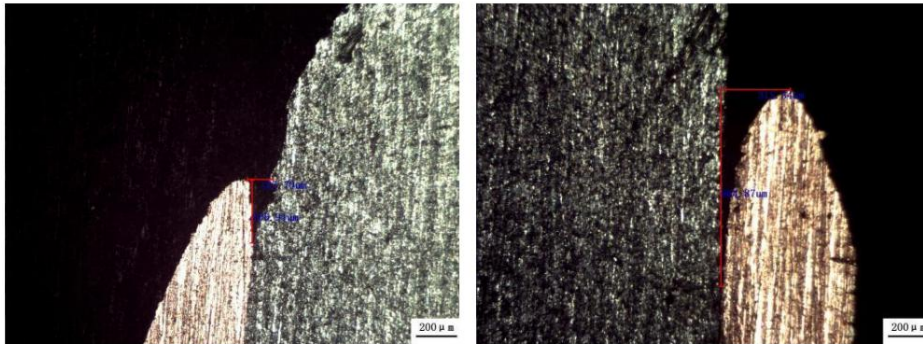
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Sample No. 4 is a cut sample from a nickel-plated end. Corrosion occurs along the copper-aluminum interface, forming pores. Pore depth...

0.199-0.965mm, pore width 0.081-0.315mm.



Sample No. 4-1



Metallographic

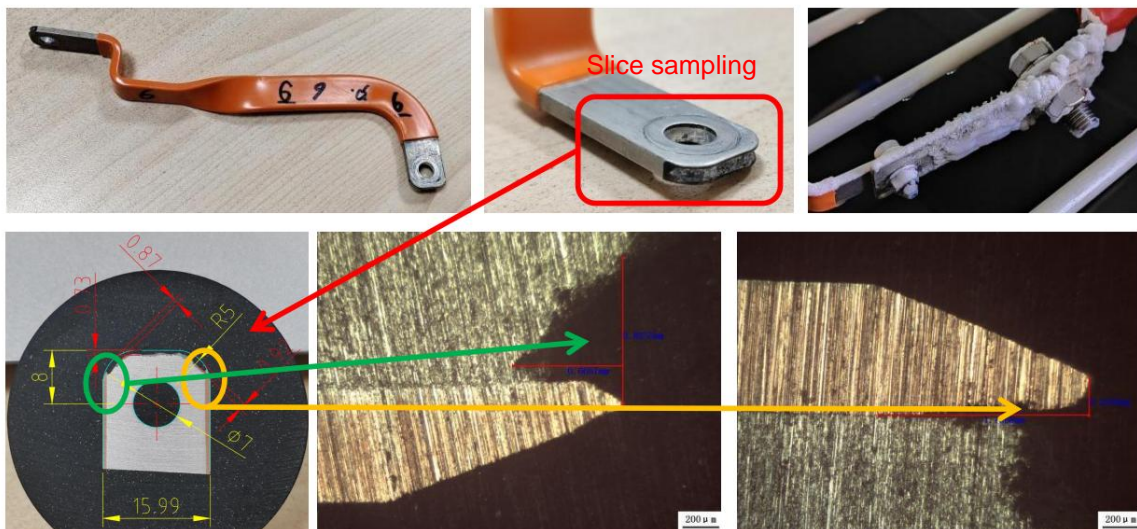
analysis was performed on sample 4 after a salt spray test of 836 hours. Samples 6 and 9 were then subjected to a salt spray test for 96 hours + 240 hours + 500 hours = 836 hours.

The ends were sliced and subjected to metallographic analysis.

4.1 Sample No. 6 is a cut sample with an electroplated nickel end. One end overlaps with sample No. 5, and the end face is not corroded; the other end connects to the connector.

Overlapping, aluminum corrosion at the end face. The maximum corrosion depth of the end pores is within the aluminum core near the bonding layer, with pore depths ranging from 0.61mm to 1.16mm.

The pore width is 0.81 mm; the corrosion depth of the aluminum core at the end is 0.73 mm to 0.92 mm.



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No. 9 is a cut sample without electroplated nickel ends. Both ends show aluminum corrosion, with a corrosion depth of 1.85mm at both aluminum cores.

The depths of corrosion on the aluminum core inside the hole are 2.26mm and 0.92mm-1.56mm. The corrosion depths are 0.26mm-2.26mm and 0.12-0.94mm respectively. In actual working conditions, the corrosion inside the hole is...

When sealed, no corrosion will occur.

