Decision on Opposition

Opposition No. 2019-700350

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The case of the opposition to the granted patent for the invention titled "MULTILAYER ALUMINUM BRAZING SHEET FOR FLUXFREE BRAZING IN CONTROLLED ATMOSPHERE" with regard to Patent No. 6415429 has resulted in the following decision.

Conclusion

Patents according to Claims 1 to 16 of Patent No. 6415429 should be maintained.

Reason

1 History of the procedures

The application (Japanese Patent Application No. 2015-514957) for the patents according to Claims 1 to 16 of Patent No. 6415429 (hereinafter referred to as "the Patent") is an application with an international filing date of May 28, 2013 (claiming priority benefit under Paris Convention for the Protection of Industrial Property from the receipt date of May 31, 2012 in Sweden (SE)), registration of the patent right was made on October 12, 2018, and a gazette containing the Patent was issued on October 31 of the same year. Thereafter, the Opponent Mita Sho (hereinafter referred to as "the Opponent") made an opposition to the granted patent for the patents according to Claims 1 to 16 on April 26, 2019.

2 The Invention

The inventions according to Claims 1 to 16 of the Patent are specified by the matters described in Claims 1 to 16 of the Scope of Claims as set forth below: It should be noted that alloy elements in Claim 1 are indented by the body.

"[Claim 1]

An aluminum alloy brazing sheet suitable for brazing to other components for flux-free brazing comprising an aluminum alloy core material that is covered by an interlayer of an aluminum alloy comprising
≤1.0 wt% Si,
0.2-2.5 wt% Mg,
≤2.0 wt% Mn,
≤1.2wt% Cu,
≤1.0 wt% Fe,
≤0.2 wt% Ti,
≤6 wt% Zn,
≤0.1 wt% Sn,
≤0.1 wt% In, and
≤0.2 wt% Zr, Cr, V and/or Sc in total, and
a plurality of unavoidable impurities each in amounts less than 0.05 wt%, and a total impurity content of less than 0.2 wt%, the balance consisting of aluminum,
the interlayer being covered by an Al-Si braze alloy which comprises
5-14 wt% Si,
<0.02 wt% Mg,
0.01-1.0 wt% Bi,
≤0.8 wt% Fe,
≤6 wt% Zn,
≤0.1 wt% Sn,
≤0.1 wt% In,
≤0.3 wt% Cu,
≤0.15 wt% Mn,
≤0.05 wt% Sr, and
a plurality of unavoidable impurities each in amounts less than 0.05 wt% and a total impurity content of less than 0.2 wt%, and the balance consisting of aluminum, wherein said core material and the interlayer have a higher melting temperature than the braze alloy, and wherein the interlayer is sacrificial to the core.

[Claim 2]

The aluminum alloy brazing sheet of Claim 1, wherein said aluminum alloy of said interlayer comprises
0.5- 2.5 wt% Mg,
Mn <2.0 wt%,
Cu ≤1.2 wt%,
Fe ≤1.0 wt%,
Si ≤1.0 wt%,
Ti ≤0.2 wt%,
Zn ≤6 wt%,
Sn ≤0.1 wt%,
In ≤0.1 wt%, and
Zr, Cr, V and/or Sc ≤0.2 wt% in total, and
a plurality of unavoidable impurities each in amounts less than 0.05 wt% and a total impurity content of less than 0.2 wt%, and a balance of aluminum.

[Claim 3]

The aluminum alloy brazing sheet of Claim 1 or 2, wherein said aluminum alloy core material is 3XXX alloy, and said aluminum comprises
Mn <2.0 wt%,
Cu ≤1.2 wt%,
Fe ≤1.0 wt%,
Si ≤1.0 wt%,
Ti ≤0.2 wt%,
Mg≤2.5 wt%,
Zr, Cr, V and/or Sc ≤0.2 wt% in total, and
a plurality of unavoidable impurities each in amounts less than 0.05 wt% and a total impurity content of less than 0.2 wt%, and a balance of aluminum.

[Claim 4]

The aluminum alloy brazing sheet of any one of Claims 1 to 3, wherein said Al-Si brazing alloy contains 0.07 to 0.2 wt% Bi.

[Claim 5]

The aluminum alloy brazing sheet of any one of Claims 1 to 4, wherein said Al-Si brazing alloy contains less than 0.01 wt% Mg.

[Claim 6]

The aluminum alloy brazing sheet of any one of Claims 1 to 5, wherein said Al-Si brazing alloy contains 7 wt% to 13 wt% Si.

[Claim 7]

The aluminum alloy brazing sheet of any one of Claims 1 to 6, wherein a melting point of said interlayer and a melting point of said core are higher than 615°C.

[Claim 8]

The aluminum alloy brazing sheet of any one of Claims 1 to 7, wherein a melting point of said brazing alloy is 550 to 590°C.

[Claim 9]

The aluminum alloy brazing sheet of any one of Claims 1 to 8, wherein a ratio of a thickness of an interlayer to a thickness of a brazing alloy layer is 25 to 250%.

[Claim 10]

The aluminum alloy brazing sheet of any one of Claims 1 to 9, wherein a thickness of said interlayer is 5 to 200 µm.

[Claim 11]

The aluminum alloy brazing sheet of any one of Claims 1 to 10, wherein said brazed sheet is a coating comprising a sacrificial coating or an Al-Si brazed coating on a side of core opposite to a side comprising an interlayer or a brazed layer.

[Claim 12]

The aluminum alloy brazing sheet of Claim 11, wherein said brazed sheet is a coating comprising a sacrificial coating on a side opposite to the core, and said sacrificial coating is covered by Al-Si brazed coating.

[Claim 13]

A brazed product comprising the aluminum alloy brazing sheet of any one of Claims 1 to 12, wherein said interlayer is sacrificial to the core.

[Claim 14]

A method of brazing a heat exchanger without flux by use of said aluminum alloy brazing sheet of any one of Claims 1 to 12 for a fin, tube, or header plate.

[Claim 15]

A heat exchanger comprising said aluminum alloy brazing sheet of any one of Claims 1 to 12.

[Claim 16]

A use of aluminum alloy brazing sheet of any one of Claims 1 to 12 for the production of a heat exchanger."

3 Outline of grounds for opposition

The Opponent submits Evidence A No. 1 and Evidence A No. 2 and alleges that the inventions according to Claims 1 to 16 of the Patent were granted a patent in violation of the provision of Article 29(2) of the Patent Act, and thus the patent according to Claims 1 to 16 of the Patent should be revoked.

(Evidence)
Evidence A No. 1: Japanese Unexamined Patent Application Publication No. 2011-38164 (hereinafter referred to as "A-1")
Evidence A No. 2: Japanese Unexamined Patent Application Publication No. 2002-18588 (hereinafter referred to as "A-2")

4 Description in Cited Documents
(1) As for A-1
A　Description of A-1
A-1 has the following description with regard to the aluminum clad material for heat exchanger (Title of the Invention).　Note that underlines are provided by the body.

"[Scope of Claims]
[Claim 1]
An aluminum-clad material for heat-exchanger made of a trilayered clad material of aluminum in which a surface of a core material is cladded with an interlayer material having a sacrificial positive electrode effect on the core material, and further the interlayer material is cladded with a clad material 1 consisting of a brazing material, wherein said core material consists of a pure material with an aluminum purity of 99.0% or more (mass%, the same shall apply hereinafter) and a content of unavoidable impurities of less than 1.0%, and contents of Cu, Mn, Mg of 0.05% or less in unavoidable impurities.
([Claim 2] to [Claim 8], Omitted)
[Claim 9]
The aluminum-clad material for heat-exchanger of any one of Claims 1 to 8, wherein said interlayer material is composed of an aluminum alloy consisting of one kind or two or more kinds of 0.5 to 10% Zn, 0.001 to 0.1% In, and 0.001 to 0.1% Sn and a balance of Al and unavoidable impurities.
[Claim 10]
The aluminum-clad material for heat-exchanger of Claim 9, wherein said interlayer material further comprises one kind or two or more kinds of 0.1 to 1.8% Mn, 0.1 to 2.0% Fe, 0.1 to 2.0% Si, 0.1 to 2.0 Ni, 0.01 to 0.3% Cr, 0.01 to 0.3 Zr, and 0.01 to 0.35% Ti.

[Claim 11]

The aluminum-clad material for heat-exchanger of any one of Claims 1 to 10, wherein said clad material 1 is composed of Al-Si-based alloy brazing material or Al-Si-Mg-based alloy brazing material.

[Claim 12]

The aluminum-clad material for heat-exchanger of Claim 11, wherein said clad material 1 is composed of an aluminum alloy brazing material consisting of one kind or two or more kinds of 2.5 to 14% Si, further 0.1 to 2.0% Mg, 0.1 to 2.0% Fe, 0.1 to 2.0% Mn, 0.01 to 0.3% Ti, 0.5 to 5.0% Zn, 0.1 to 5.0% Cu, 0.001 to 0.1% Sr, 0.001 to 0.1% Na, 0.001 to 0.1% Sb, 0.001 to 0.2% Bi, and 0.001 to 0.1% Be, as well as a balance Al and unavoidable impurities.

([Claim 13] to [Claim 17], omitted)"

"[Technical field]

[0001]

The present invention relates to an aluminum clad material suitable for the use in tube material or plate material, which is a constitutional member of a heat exchanger made of aluminum alloy such as a radiator or inverter cooler, particularly for the use in a heat exchanger to be produced by brazing joints such as brazing using fluorinated flux or vacuum brazing."

"[Problem to be solved by the Invention]

[0005]

It is important to have fatigue characteristics that can bear fatigue due to stress such as vibration imposed on a heat exchanger, particularly in a heat exchanger made of aluminum alloy for automobiles, and it is desirable to have excellent fatigue resistance for members such as tube material and plate material. The present inventors have found that the use of pure aluminum as a core material in which the additive amounts of components are reduced to suppress the production of intermetallic compounds produced by the components and decreasing solid solution of Cu, Mn, Mg is effective for the improvement of fatigue life, in particular improvement of low-cycle fatigue life, as a result of the review of the compositions of core material that constitutes a clad material and a sacrificial positive electrode material and the combination thereof, and tests and investigations of the correlation of these factors with the fatigue life of the clad material in order to obtain a member for a heat exchanger having excellent fatigue characteristics and corrosion resistance.

[0006]

The present invention has been made as a result of further tests and investigation on the basis of the above findings. The objective is to provide an aluminum clad material for heat exchanger suitable for the use in raw materials of tube material and plate material of a heat exchanger made of aluminum alloy having excellent fatigue characteristics and excellent corrosion resistance."

"[Advantage of the Invention]

[0024]

The present invention provides an aluminum alloy clad material for heat exchanger with excellent fatigue properties, in particular low cycle fatigue properties and excellent corrosive properties, as well as excellent corrosion resistance, suitably used as a raw material of tubes and plates, which are the components of a heat exchanger made of aluminum alloy."

"[Description of Embodiments]

[0026]

An explanation is given to the meaning of alloy component in aluminum clad material for heat exchanger by the present invention and reasons for the limitations.

(Core material)

For the core material, the use of pure aluminum with a content of unavoidable impurities of less than 1.0% and an aluminum purity of 99.0% or more may effectively achieve improved fatigue life, in particular low-cycle fatigue life."

"[0035]

(Interlayer material)

Zn, In, and Sn render the electric potential of interlayer material less noble to retain the sacrificial positive electrode effect on a core material. As a result, the pitting corrosion of the core material is prevented. The preferable content of Zn is 0.5 to 10.0%, further preferably 1 to 5%; the preferable range of In is 0.001 to 0.1%, further preferable range is 0.01 to 0.05%; and the preferable range of Sn is 0.001 to 0.1%, further preferable range is 0.01 to 0.05%.

[0036]

Mn produces an Al-Mn-based compound that becomes a starting point of corrosion, and the pitting corrosion is dispersed, which improves the corrosion resistance. The preferable content of Mn is 0.1 to 2.0%. If the content exceeds 2.0%, a coarse compound is produced in casting, which compromises rolling processability and makes it hard to obtain a favorable plate material. Further preferable content of Mn ranges from 0.5 to 1.7%.

[0037]

Fe produces an Al-Fe-based compound that becomes a starting point of corrosion, and the pitting corrosion is dispersed, which improves the corrosion resistance. The preferable content of Fe is 0.1 to 2.0%. If the content exceeds 2.0%, the corrosion resistance deteriorates. Further preferable content of Fe is 0.2 to 1.0%.

[0038]

Si produces an Al-Si-based compound that becomes a starting point of corrosion, and the pitting corrosion is dispersed, which improves the corrosion resistance. The preferable content of Si is 0.1 to 2.0%. If the content exceeds 2.0%, the corrosion resistance deteriorates. The further preferable content of Si is 0.2 to 1.0%.

[0039]

Ni produces an Al-Ni-based compound that becomes a starting point of corrosion, and the pitting corrosion is dispersed, which improves the corrosion resistance. The Ni content is preferably in a range of 0.1 to 2.0%. If the content exceeds 2.0%, the corrosion resistance deteriorates. The Ni content is further preferably in a range of 0.2 to 1.0%.

[0040]

Cr and Zr elevate the recrystallization temperature in brazing heating and make the crystal particle size of the clad material 1 coarse to suppress the erosion in brazing heating. The preferable contents of Cr and Zr are both from 0.01 to 0.3%. If the content exceeds 0.3%, the effects are saturated, and further improvement of effects may not be expected. Further preferable content of Cr and Zr is 0.05 to 0.2%.

[0041]

Ti is divided into a high-concentration region and a low-concentration region in a plate thickness direction of interlayer material, and these are alternatingly distributed in layers, and a region with a low Ti concentration is preferentially corroded in comparison to a high Ti concentration region to cause the effects of making a form of corrosion in layers, and prevent the progression of corrosion in a plate thickness direction to thereby improve the resistance to the pitting corrosion of materials. The preferable content of Ti is 0.35% or less. If the content exceeds 0.35%, casting becomes difficult, and further processability deteriorates to make the production of healthy material difficult. The further preferable content of Ti is in a range of 0.1 to 0.2%.

[0042]

Further, an interlayer material may comprise an element to be added to a publicly known sacrificial positive electrode material, for example, 0.2% or less Cu, 3.0% or less Mg, 0.3% or less V, 0.3% or less Co, 0.3% or less Ce, 0.3% or less Y, 1.0% or less La, 1.0% or less Nd, and 1.0% or less Pr."

"[0043]

(Clad material 1)

For the clad material 1, an Al-Si-based alloy or Al-Si-Mg-based alloy is used as braze material. The content range of Si is 2.5 to 14%, and the content range of Mg is 0.1 to 2.0%.

[0044]

Al-Si-based alloy and Al-Si-Mg-based alloy may contain as necessary one kind or two or more kinds of 0.1 to 2.0% Fe, 0.1 to 2.0% Mn, 0.01 to 0.3% Ti, 0.5 to 5.0% Zn, 0.1 to 5.0% Cu, 0.001 to 0.1% Sr, 0.001 to 0.1% Na, 0.001 to 0.1% Sb, 0.001 to 0.2% Bi, and 0.001 to 0.1% or less Be. In addition, the clad material 1 may contain an element to be added to a publicly known braze material, for example, 0.3% or less V, 0.3% or less Co, 0.3% or less Ce, 0.3% or less Y, 1.0% or less La, 1.0% or less Nd, 1.0% or less Pr, 0.3% or less Cr, or 0.3% or less Zr."

"[Examples]

[0049]

Hereinafter, an explanation is given by comparing the examples of the present invention to comparative examples, and the effects thereof are demonstrated. These examples show an embodiment of the present invention. The present invention is not limited thereto.

[0050]

Example 1

Aluminum for core material having a composition shown in Table 1, aluminum alloy for interlayer material having a composition shown in Table 2, and aluminum alloy for the clad material 1 having a composition shown in Table 3 were made into ingots by continuous casting. Of the ingots thus obtained, an aluminum for core material was subjected to homogenization treatment, and an aluminum alloy for interlayer material and an aluminum alloy for the clad material 2 were subjected to hot rolling to have a certain thickness, and these were combined with an ingot of aluminum for core material and subjected to hot rolling to obtain a trilayered clad material.

Further, in an aluminum for core material shown in Table 1, the amount of unavoidable impurities other than elements in Table 1 was: 500 ppm or less for both A1 and A5, 10 ppm or less for both A2 and A6, 5 ppm or less for both A3 and A7, and 1 ppm or less for both A4 and A8.

[0051]

【表１】

No.	組　成（mass%）					
	Al	Ti	Cu	Mn	Mg	Si
A1	99.5	—	0.02	0.02	0.02	0.1
A2	99.92	—	0.002	0.002	0.002	0.01
A3	99.993	—	0.0003	0.0002	0.0002	0.001
A4	99.9992	—	0.00002	0.00003	0.00002	0.0001
A5	99.4	0.1000	0.02	0.02	0.02	0.1
A6	99.91	0.0300	0.002	0.001	0.002	0.01
A7	99.992	0.0030	0.0002	0.0003	0.0002	0.001
A8	99.9991	0.0003	0.00002	0.00003	0.00002	0.0001

【表１】　[Table 1]

組成　Composition

[0052]

【表２】

No.	組　成（mass%）									
	Si	Fe	Cu	Mn	Mg	Zn	Cr	Ti	In	Sn	その他
B1	0.2	0.20	—	—	—	1.0	—	—	—	—	
B2	0.2	0.20	—	—	—	2.5	—	—	—	—	
B3	0.2	1.00	—	—	—	2.5	—	—	—	—	
B4	0.2	0.20	—	—	—	—	—	—	0.02	—	
B5	0.2	0.20	—	—	—	—	—	—	—	0.02	
B6	0.2	0.20	—	—	—	8.0	—	—	—	—	
B7	0.2	1.00	—	1.00	—	2.5	—	—	—	—	
B8	1.5	0.50	—	—	—	2.5	—	—	—	—	
B9	0.2	0.20	—	—	—	—	0.20	—	—	—	Ni:1.0
B10	0.2	0.20	—	—	—	—	—	0.15	—	—	Zr:0.1
B11	0.2	0.20	0.10	—	0.10	3.0	—	—	—	—	

【表２】　[Table 2]

組成　Composition

その他　Others

[0053]

【表３】

No.	組　成（mass%）								
	Si	Fe	Cu	Mn	Mg	Zn	Cr	Ti	その他
C1	10.0	0.30	—	—	—	—	—	—	
C2	10.0	0.30	—	—	1.50	—	—	—	
C3	3.0	0.30	—	—	—	—	—	—	
C4	13.0	0.30	—	—	—	—	—	—	
C5	10.0	0.30	1.00	—	—	1.0	—	—	
C6	10.0	1.00	—	0.50	—	—	—	0.15	
C7	10.0	0.30	—	—	—	—	—	—	Sr:0.02
C8	10.0	0.30	—	—	—	—	—	—	Na:0.02
C9	10.0	0.30	—	—	—	—	—	—	Sb:0.02
C10	10.0	0.30	—	—	—	—	—	—	Bi:0.1
C11	10.0	0.30	—	—	—	—	0.10	—	Be:0.01

【表３】	[Table 3]
組成	Composition
その他	Others

[0054]

Subsequently, the clad material was subjected to cold rolling and final annealing to obtain a 0.40 mm-thick clad plate material. The clad composition was a clad rate of the interlayer material 1 of 10% (0.040 mm thick), a clad rate of the clad material 1 of 10% (0.040 mm thick), and the balance was a core material. It should be noted that the plate thickness and clad rate are not limited to the examples but are adjusted as necessary for the use. For example, a sheet thickness may be set to 0.10 to 2.00 mm, and clad rate may be set to approximately 2 to 20%.

[0055]

The aluminum clad material thus obtained served as a sample material and was heated for 3 minutes at 600°C in a nitrogen atmosphere (material temperature) without coating flux on the clad material, and thereafter fatigue life was measured by a plane folding fatigue test. The plane folding fatigue test consisted of cutting a clad material after the braze heating, and then machining an end face to produce a strip specimen with 5 mm-width, and for the strip specimen, a completely reversed bending fatigue test was conducted by use of a bending fatigue testing machine shown in Figure 1 with a strain range being fixed to 0.67. The test was conducted at room temperature and a frequency of 0.5 Hz to measure a cycle number until the sample breaks. The fatigue life was evaluated in a low-cycle region where times of breakage is about 10^4, and evaluated as good (○) when the fatigue life exceeds $1*10^4$. The results are shown in Table 4.

[0056]

Further, the number of intermetallic compound particles having a particle diameter in a core material of a sample material of 1 μm or more per 1 mm^2 was measured. The method of measuring the number of intermetallic compound particles having a particle diameter in a core material of 1 μm or more is set forth as below: The core material was imaged by an optical microscopy at a magnitude of 200 times from five views (total area of 0.15 mm^2), and the number of intermetallic compound particles having a particle diameter in a core material of 1 μm or more was measured by an image analysis apparatus. The results are shown in Table 4.

[0057]

【表４】

試験材No.	皮材１No.	中間材No.	心材No.	皮材２No.	皮材３No.	金属間化合物の個数	疲労寿命×10⁴
1	C1	B2	A1	－	－	1×10^4	1.100
2	C1	B2	A2	－	－	2×10^3	1.200
3	C1	B2	A3	－	－	2×10^2	1.230
4	C1	B2	A4	－	－	1×10	1.310
5	C1	B2	A5	－	－	1.2×10^4	1.210
6	C1	B2	A6	－	－	1.8×10^3	1.330
7	C1	B2	A7	－	－	2.1×10^2	1.400
8	C1	B2	A8	－	－	1.1×10	1.520
9	C1	B1	A2	－	－	2×10^3	1.150
10	C1	B3	A2	－	－	2×10^3	1.130
11	C1	B4	A2	－	－	2×10^3	1.150
12	C1	B5	A2	－	－	2×10^3	1.120
13	C1	B6	A2	－	－	2×10^3	1.140
14	C1	B7	A2	－	－	2×10^3	1.120
15	C1	B8	A2	－	－	2×10^3	1.130
16	C1	B9	A2	－	－	2×10^3	1.120
17	C1	B10	A2	－	－	2×10^3	1.120
18	C1	B11	A2	－	－	2×10^3	1.130
19	C1	B1	A5	－	－	1.2×10^4	1.220
20	C1	B3	A5	－	－	1.2×10^4	1.230
21	C1	B4	A5	－	－	1.2×10^4	1.210
22	C1	B5	A5	－	－	1.2×10^4	1.220
23	C1	B6	A5	－	－	1.2×10^4	1.220
24	C1	B7	A5	－	－	1.2×10^4	1.220
25	C1	B8	A5	－	－	1.2×10^4	1.230
26	C1	B9	A5	－	－	1.2×10^4	1.220
27	C1	B10	A5	－	－	1.2×10^4	1.230
28	C1	B11	A5	－	－	1.2×10^4	1.220
29	C2	B1	A2	－	－	2×10^3	1.120
30	C3	B2	A2	－	－	2×10^3	1.130
31	C4	B3	A2	－	－	2×10^3	1.110
32	C5	B1	A2	－	－	2×10^3	1.120
33	C6	B2	A2	－	－	2×10^3	1.130
34	C7	B3	A2	－	－	2×10^3	1.130
35	C8	B1	A2	－	－	2×10^3	1.150
36	C9	B2	A2	－	－	2×10^3	1.140
37	C10	B3	A2	－	－	2×10^3	1.130
38	C11	B3	A2	－	－	2×10^3	1.120
39	C2	B1	A5	－	－	1.2×10^4	1.230
40	C3	B2	A5	－	－	1.2×10^4	1.230
41	C4	B3	A5	－	－	1.2×10^4	1.220
42	C5	B1	A5	－	－	1.2×10^4	1.230
43	C6	B2	A5	－	－	1.2×10^4	1.240
44	C7	B3	A5	－	－	1.2×10^4	1.220
45	C8	B1	A5	－	－	1.2×10^4	1.220
46	C9	B2	A5	－	－	1.2×10^4	1.230
47	C10	B3	A5	－	－	1.2×10^4	1.230
48	C11	B3	A5	－	－	1.2×10^4	1.220
49	C1	B2	A1	C1	－	1×10^4	1.120
50	C1	B2	A1	－	B2	1×10^4	1.120
51	C1	B2	A5	C1	－	1.2×10^4	1.230
52	C1	B2	A5	－	B2	1.2×10^4	1.240

【表４】 [Table 4]

試験材 Sample material

皮材 Clad material

中間材 Interlayer material

心材	Core material
金属間化合物の個数	Number of intermetallic compound
疲労寿命	Fatigue life

[0058]

As shown in Table 4, the test materials 1 to 52 according to the present invention have excellent fatigue properties including a fatigue life beyond $1*10^4$."

B The invention described in A-1

(A) According to the above A, an aluminum-clad material for heat-exchanger described in A-1 is a trilayered clad material of aluminum in which on a surface of a core material cladded is an interlayer material having a sacrificial positive electrode effect on the core material, and further the interlayer material is cladded with a clad material 1 consisting of a brazing material, wherein said core material consists of a pure material with an aluminum purity of 99.0% or more (Claim 1).

Further, said interlayer material is composed of aluminum alloy that comprises one kind or two or more kinds of Zn, In, and Sn, and further comprises one kind or two or more kinds of Mn, Fe, Si, Ni, Cr, Zr, and Ti, and a balance of Al and unavoidable impurities (Claims 9, 10). An element to be added to a publicly known sacrificial positive electrode material may include, for example, Cu, Mg, V, Co, Ce, Y, La, Nd, and Pr (paragraph [0042]), and 11 kinds of B1 to B11 are shown as specific alloy compositions (paragraph [0052], Table 2).

Further, said clad material 1 is composed of Al-Si-based alloy braze material or Al-Si-Mg-based alloy braze material containing Si and further containing one kind or two or more kinds of Mg, Fe, Mn, Ti, Zn, Cu, Sr, Na, Sb, Bi, and Be, and a balance of Al and unavoidable impurities (Claims 11 and 12, paragraph [0043]), and 11 kinds of C1 to C11 are shown as specific alloy compositions (paragraph [0053], Table 3).

Further, specific examples of an aluminum clad material obtained by combining an aluminum for core material, said interlayer material, and said clad material 1 are set forth as per the sample materials 1 to 52 (paragraph [0057], Table 4).

(B) It is a common general knowledge that a technical significance exists in an alloy containing certain amounts of certain alloy elements, properties of the alloy are determinded and caused only on the basis of the amounts of the alloy elements actually prepared, properties of alloys will vary according to the amounts of the elements or production method of the arroys, which control the structure of the metal of the arroy, even if the elements are identical, and properties of an alloy is difficult to predict. (See, if necessary, 2017 (Gyo-Ke) No.10121.)

In contrast, the Opponent alleges that A-1 describes in paragraph [0042] that "Further, an interlayer material may contain ... 3.0% or less Mg ...", and in Table 2 that an aluminum alloy for interlayer material contains 0 to 0.1% Mg, and thus A-1 describes that an interlayer material may contain 0 to 3.0% Mg (the written Opposition to the granted Patent, page 12).

However, taking into account the above common general knowledge about the alloy composition, it is impossible to find the alloy composition of interlayer material according to the A-1 invention without specific alloy compositions. Therefore, the above Opponent's allegation is not acceptable.

(C) Therefore, when a consideration is given to the closest alloy composition of "interlayer material" in the invention according to Claim 1 of the Patent from the specific alloy composition of "interlayer material" described in A-1 in view of the common general knowledge of the above (B), it is only B11 that contains Mg. Further, the composition of B11 is set forth below (paragraph [0052], Table 2).
Si: 0.2 mass%
Fe: 0.20 mass%
Cu: 0.10 mass%
Mg: 0.10 mass%
Zn: 3.0 mass%
Balance: Al and unavoidable impurities

(D) Similarly, when a consideration is given to the closest alloy composition of "Al-Si braze alloy" in the invention according to Claim 1 of the Patent from the specific alloy composition of "clad material 1" described in A-1 in view of the general concept of the alloy of the above (B), it is only C10 that contains Bi. Further, the composition of C10 is set forth below (paragraph [0053], Table 3).
Si: 10.0 mass%
Fe: 0.30 mass%
Bi: 0.1 mass%
Balance: Al and inevitable impurities

(E) For the above reasons, it can be said that A1 describes the following invention (hereinafter referred to as "Invention A-1"):

"An aluminum-clad material for a heat-exchanger made of a trilayered clad material of aluminum in which a surface of a core material is cladded with an interlayer material having a sacrificial positive electrode effect on the core material, and further the interlayer material is cladded with a clad material 1 consisting of a brazing material, wherein said core material consists of a pure material with an aluminum purity of 99.0% or more (mass%, the same shall apply hereinafter)

and said interlayer material contains 0.2% Si, 0.20% Fe, 0.10% Cu, 0.10% Mg, and 3.0% Zn as well as a balance Al and unavoidable impurities,

wherein said clad material 1 is composed of an aluminum alloy braze material containing 10.0% Si, and further containing 0.30% Fe and 0.1% Bi as well as a balance Al and unavoidable impurities."

(2) As for A-2

A　Description of A-2

A-2 has the following description with regard to the aluminum clad material for heat exchanger with excellent corrosive resistance (Title of the Invention).　Note that underlines are provided by the body.

"[Scope of Claims]

[Claim 1]

An aluminum alloy clad material for heat exchanger with excellent corrosion resistance, in which a braze material is cladded at least on a side of an interlayer material of a bilayer structure of a core material and the interlayer material, wherein said core material is composed of aluminum alloy comprising 0.5% to 1.5% Mn (mass%, the same shall apply hereinafter), 0.36% to 0.9% Cu, 0.06% to 0.6% Mg, 0.06% to 0.30% Ti, 0.01% to 0.5% Si, 0.01% to 0.5% Fe, and a balance of Al and unavoidable impurities, wherein said interlayer material is composed of aluminum alloy comprising 0.55% to 0.9% Mg, 0.06% to 0.5% Cu, 1.0% to 6.0% Zn, and a balance of Al and unavoidable impurities, wherein said braze material is composed of aluminum alloy comprising Si, and the relationship between Cu amount of core material and Cu amount of interlayer material is set to (Cu amount % of core material - Cu amount % of interlayer material) $\geq$ 0.30%, and the relationship between Cu amount of core material and interlayer material and Zn amount of interlayer material is set to (Cu amount % of core material + Cu amount % of interlayer material)/(Zn amount of interlayer material)$\leq$0.5.

[Claim 2]

The aluminum alloy clad material for heat exchanger with excellent corrosive resistance of Claim 1, wherein said interlayer material further comprises 0.06 to 0.30% Ti.

[Claim 3]

The aluminum alloy clad material for heat exchanger with excellent corrosive resistance of Claim 1 or 2, wherein said braze material further comprises one kind or more of 0.005% to 0.20% In and 0.01% to 0.20% Sn."

"[0001]

[Field of the Invention] The present invention relates to an aluminum alloy clad material for heat exchanger with excellent corrosion resistance, specifically an aluminum alloy clad material for heat exchanger with excellent molding properties before brazing and high strength after brazing; the clad material is used as a component material of a working fluid channel of a heat exchanger to be adhered by brazing, such as an evaporator or intercooler of a car air conditioner.

[0002]

[Conventional Art] A heat exchanger made of aluminum alloy is widely used as a heat exchanger for a radiator, oil cooler, intercooler, and heater of an automobile, an evaporator and condenser of air conditioner, or an oil compressor, oil cooler, etc. of an industrial machine. There are various types of heat exchangers made of aluminum alloy. From a viewpoint of reducing weight, a bundle of aluminum alloy clad materials is subjected to mold processing and stacked to form a working fluid channel. Between the working fluid channel, fins made of a corrugated aluminum alloy are combined and integrated by brazing to manufacture a laminated heat exchanger (Drawn Cup-type heat exchanger), which draws much attention and is particularly common as an evaporator.

[0003] A core plate of this drawn cup-type heat exchanger may use an aluminum alloy having Mn such as Al-Mn-based, Al-Mn-Cu-based, Al-Mn-Mg-based, Al-Mn-Cu-Mg-based alloys, for example, JIS A3003 alloy, and 3005 alloy for the core material, and a braze may use an Al-Si-based alloy such as Al-Si-based, Al-Si-Mg-based, Al-Si-Mg-Bi-based, Al-Si-Mg-Be-based, Al-Si-Bi-based, Al-Si-Be-based, and Al-Si-Bi-Be-based alloys for braze material, and an aluminum alloy clad material in which the above braze material is cladded on one or both surface(s) of said core material."

"[0012]

[Problem to be solved by the Invention] The present invention was made as a result of multifaceted experiment and investigation for materials of core material, interlayer material, and braze material with regard to molding processability, brazing properties, strength characteristics after brazing, and corrosion resistance in order to obtain an aluminum alloy clad material that solves the above conventional problem in a fluid channel material of heat exchanger made of aluminum and satisfies the requirement of thinner working fluid channel material. The object is to provide an aluminum alloy clad material for heat exchanger particularly suitable for use in a core plate material for a drawn cup-type heat exchanger with excellent corrosion resistance, and superior molding processability before brazing and that is easy to braze and has high strength after brazing."

"[0017]
Hereinafter, an explanation is given to the meaning of alloy component in aluminum clad material for heat exchanger with excellent corrosion resistance of the present invention (hereinafter simply referred to as aluminum alloy clad material) and the reasons for the limitation.
(1) Components of braze material
Mn in core material improves the strength of the core material and makes the potential of the core material noble to make a potential difference from braze material and fin material of surface of aluminum alloy clad material greater and function to improved corrosion resistance of aluminum clad material. The preferable content of Mn is 0.5 to 1.5%. If the content is less than 0.5%, the effect is insufficient. If the content exceeds 1.5%, a coarse compound is produced in casting, which compromises rolling processability and makes it hard to obtain a favorable plate material."

"[0023] (2) Components of intermediate layer material
Mg in an interlayer material functions to improve the strength of the interlayer material. The preferable content of Mg ranges from 0.55% to 0.9%. If the content is less than 0.55%, the effect is insufficient, and if the content exceeds 0.9%, elongation is decreased to make the molding processability insufficient and decrease the corrosion resistance of interlayer material itself.
[0024]
Cu in an interlayer material functions to improve the strength of the interlayer material. The preferable content of Cu is 0.06% to 0.5%. If the content is less than

0.06%, the effect is insufficient. If the content exceeds 0.5%, the corrosion resistance of interlayer material itself deteriorates.

[0025]

Ti makes the corrosion resistance of interlayer material further improved. Specifically, Ti in an interlayer material is divided into a high-concentration region and a low-concentration region to coagulate, and these are alternatingly distributed in layers in a plate thickness direction, and a region with a low Ti concentration is preferentially corroded in comparison to a high Ti concentration region to cause the effects of making a form of corrosion in layers, and prevent the progression of corrosion in a plate thickness direction to thereby improve the resistance to pitting corrosion. The preferable content of Ti is 0.06 to 0.30%. If the content is less than 0.06%, the effect is insufficient. If the content exceeds 0.30%, a coarse compound is produced in casting, and rolling processability is inhibited.

[0026]

Zn makes the potential of the interlayer material less noble to make a potential difference from core material on a surface of aluminum alloy clad material greater and imparts excellent sacrificial positive electrode effects on the core material to the interlayer material, and functions to improve the corrosion resistance of aluminum alloy clad material. The preferable content of Zn is 1% to 6%. If the content is less than 1%, the effect is insufficient. If the content exceeds 6%, local melting of the core material is likely to occur in brazing.

[0027]

Besides the elements such as In, Sn, Cr, Zr, Si and Fe may be contained in a range that does not compromise the effect of the present invention. In and Sn are assumed to make the potential of the interlayer material further less noble. Thus, In is preferably in a range of 0.005% to 0.2%, and Sn is preferably in a range of 0.01% to 0.2%. Cr and Zr contents are preferably limited to 0.3% or less so as not to compromise the rolling ability of materials. Further, Si and Fe contents are preferably limited to 0.5 % or less so as not to compromise corrosion resistance."

"[0028] (3) Components of braze material

For braze materials, a braze material of Al-Si-based alloy containing Si is used. In a case of a vacuum brazing, for example, a braze material of Al-Si-Mg-based alloy having 6% to 13% Si and 0.2% to 2.0% Mg is used. In a case of a flux brazing, for example, a braze material of Al-Si-based alloy containing 6% to 13% Si is used.

[0029]

In and Sn in a braze material make the potential of a braze material less noble to make a potential difference between a core material and an interlayer material of an aluminum alloy clad material greater and impart excellent sacrificial positive electrode effects on the core material and the interlayer material, and function to make a form of corrosion of aluminum alloy clad material in a form of the whole surface corrosion and improve the corrosion resistance of aluminum alloy clad material. Preferable contents of In and Sn are 0.005% to 0.2% In and 0.01% to 0.2% Sn. The effects are insufficient at a level lower than a lower limit, whereas beyond the upper limit value, rolling of materials becomes difficult, and obtaining a favorable material becomes difficult. In the present invention, the effect of the invention would not be compromised even by use of another brazing method or by use of a braze material to which other elements such as Bi, Be, Cu, and Zn are added."

"[0034]

[Examples] Hereinafter, an explanation is given by comparing the examples of the present invention to comparative examples. These examples show preferable embodiments of the present invention. The present invention is not limited thereto.

Example 1

Aluminum alloys for core material having the compositions shown in Table 1 (compositions shown in core material Nos. 1 to 8), aluminum alloys for interlayer material having the compositions shown in Table 2 (compositions shown in interlayer material Nos. 1 to 5) and aluminum alloys for braze material having the compositions shown in Table 3 (compositions shown in braze material Nos. A to E) were respectively made into ingots by semicontinuous casting. A core material was made by machining to 16.5 mm-thickness, and aluminum alloys for interlayer material and aluminum alloys for braze material were subjected to hot rolling after machining to make a 4.5 mm-thick interlayer material and braze material. These raw materials were laminated in the order of braze material/interlayer material/core material/braze material, and subjected to hot rolling to obtain a four-layered aluminum alloy clad material with a thickness of 3 mm. Thereafter, the resultant four-layered aluminum alloy clad material was subjected to cold rolling down to 0.4 mm-thickness and final annealing to produce an aluminum alloy clad material.

[0035]

【表１】

芯材 No.	組 成 (mass%)					
	Mn	Cu	Mg	Ti	Si	Fe
1	0.55	0.65	0.2	0.2	0.1	0.2
2	0.57	0.90	0.4	0.15	0.06	0.1
3	0.8	0.57	0.2	0.2	0.1	0.2
4	0.8	0.75	0.55	0.25	0.2	0.4
5	1.2	0.4	0.1	0.09	0.15	0.2
6	1.2	0.62	0.3	0.2	0.45	0.3
7	1.4	0.36	0.3	0.2	0.1	0.06
8	1.5	0.62	0.09	0.1	0.3	0.15

【表１】 [Table 1]
芯材 Core material
組成 Composition

[0036]

【表２】

中間層材 No.	組 成 (mass%)					
	Zn	Cu	Mg	Ti	Si	Fe
1	1	0.06	0.8	—	0.05	0.1
2	2	0.1	0.65	—	0.1	0.2
3	5	0.35	0.55	—	0.15	0.3
4	3	0.2	0.6	0.1	0.1	0.2
5	6	0.45	0.85	0.2	0.15	0.3

【表２】 [Table 2]
中間層材 Interlayer material
組成 Composition

[0037]

【表３】

ろう材 No.	組 成 (mass%)				
	Si	Mg	In	Sn	Fe
A	10	1.4	—	—	0.3
B	10	1.4	0.01	0.2	0.3
C	10	1.4	0.04	—	0.3
D	10	1.4	—	0.06	0.3
E	10	1.4	0.1	0.1	0.3

【表３】 [Table 3]
ろう材 Braze material
組成 Composition

[0038]

Aluminum alloy clad materials thus obtained (sample material Nos. 1 to 11) were evaluated in compliance with the following method in terms of (1) Molding Processability, (2) Brazing properties, (3) Corrosion resistance, and (4) Strength after brazing.

(1) Molding Processability

A tensile test was conducted for the above aluminum alloy clad materials to measure an elongation (%). One having an elongation of 20% or less was evaluated as insufficient molding processability. Specifically, press molding of core plate material for a drawn cup-type evaporator tends to generate cracking during processing in a case of an elongation of material of 20% or less.

[0039]

(2) Brazing properties

A circular plate material was cut out from an aluminum alloy clad material 1 and subjected to press molding so that a plate material may be oriented with an interlayer material being projected as shown in Figure 2. The resultant cup-shaped press mold 7 was alternatingly stacked and subjected to vacuum brazing in a condition of heating for 3 minutes at a temperature of 600°C under a vacuum atmosphere ($5*10^{-5}$ Torr or less) to produce a brazed mold 8 as shown in Figure 3. This brazed mold 8 was observed visually, and ranked as having good brazing properties (○) for ones brazed well and poor brazing properties (×) for ones in which poor brazing such as local melting occurred.

[0040]

(3) Corrosion resistance

For a brazed mold, CASS test was implemented for 8 weeks in compliance with JIS H8681 to measure a maximum corrosion depth (mm) of aluminum alloy clad material from a side of an interlayer material after CASS test.

(4) Strength after brazing

An aluminum alloy clad material (single plate) was subjected to the above heating for brazing in vacuum and a tensile test was conducted for a plate material after heating to measure tensile strength (MPa).

[0041]

The evaluation results are shown in Table 4. As shown in Table 4, it was recognized that the sample materials (Nos. 1 to 11) satisfying the condition of the present invention had an elongation exceeding 20% and good molding processability. The samples have good brazing properties and the strength after brazing showed an excellent value of 145 MPa or more. For corrosion resistance, a maximum corrosion depth after CASS test was as shallow as 0.08 to 0.15 mm to exhibit excellent corrosion resistance. Further, these sample materials showed excellent producibility without causing any problem in producing a material.

[0042]

[Table 4]

試験材	芯材	中間層	ろう材	素材の伸び%	ろう付加熱後引張強さMPa	CASS試験後最大腐食深さmm	Cu量の差	Cu量とZn量との比	ろう付け性
1	1	2	A	28	146	0.12	0.55	0.38	○
2	2	5	A	22	178	0.09	0.45	0.23	○
3	3	2	A	27	148	0.11	0.47	0.34	○
4	4	3	A	22	178	0.10	0.40	0.22	○
5	5	1	A	29	145	0.15	0.34	0.46	○
6	6	2	A	23	170	0.12	0.52	0.36	○
7	7	1	A	24	163	0.15	0.30	0.42	○
8	8	4	B	24	163	0.08	0.42	0.27	○
9	1	4	C	28	146	0.08	0.45	0.28	○
10	3	4	D	26	149	0.08	0.37	0.26	○
11	8	2	E	24	163	0.09	0.52	0.36	○

試験材	Sample material
芯材	Core material
中間層	Interlayer

ろう材	Braze material
素材の伸び	Elongation of material
ろう付加熱後引張強さ	Tensile strength after heating for brazing
ＣＡＳＳ試験後最大腐食深さ	Maximum corrosion depth after CASS test
Ｃｕ量の差	Difference in Cu content
Ｃｕ量とＺｎ量との比	Ratio of Cu content to Zn content
ろう付け性	Brazing properties
《表注》Cu 量の差:	<<Table's Note>>A difference in Cu content:

（芯材の Cu 量%－中間層材の Cu 量%） (Cu content of core material % - Cu content of interlayer material %)

(芯材の Cu 量%＋中間層材の Cu 量%) /(中間層材の Zn 量%） (Cu content of core material % + Cu content of interlayer material %)/(Zn content of interlayer material %)"

B The invention described in A-2

(A) According to the above point A, an aluminum alloy clad material for heat exchanger described in A-2 has a structure in which a braze material is cladded at least on a side of an interlayer material of a bilayer structure of a core material and the interlayer material, and said core material is composed of aluminum alloy containing Mn, Cu, Mg, Ti, Si, and Fe and a balance of Al and unavoidable impurities (Claim 1).

Further, said interlayer material is composed of an aluminum alloy comprising Mg, Cu, Zn, and further Ti as well as a balance of Al and unavoidable impurities (Claims 1, 2, paragraphs [0023] to [0026]). In addition, it may include elements such as In, Sn, Cr, Zr, Si, and Fe (paragraph [0027]) and five kinds of interlayer materials Nos. 1 to 5 as specific alloy compositions (paragraph [0036], Table 2).

Further, said braze material is composed of an aluminum alloy comprising Si; Al-Si-Mg-based alloy braze material for the case of vacuum brazing; Al-Si-based alloy braze material for the case of flux brazing (Claim 1, paragraph [0028]) further contains one or more kinds of In and Sn (Claim 3), and the other elements such as Bi, Be, Cu, and Zn may be added to a braze material (paragraph [0029]) and five kinds of braze materials Nos. A to E are shown as specific alloy compositions (paragraph [0037], Table 3).

Further, specific examples of an aluminum clad material obtained by combining an aluminum alloy for core material, an aluminum alloy for said interlayer material, and an aluminum alloy for said braze material are set forth as per the sample materials 1 to 11 (paragraph [0042], Table 4).

(B) Here, the common general knowledge of alloy composition is as per the above (1)B(B).

(C) Therefore, when a consideration is given to the closest alloy compositions of "interlayer material" in the invention according to Claim 1 of the Patent from the specific alloy composition of "interlayer material" described in A-2 in view of the general concept of the above alloy (B), they are No. 4, No. 5, and these compositions are set forth below (paragraph [0036], Table 2).

	(No. 4)	(No. 5)
Zn:	3 mass%	6 mass%
Cu:	0.2 mass%	0.45 mass%
Mg:	0.6 mass%	0.85 mass%
Ti:	0.1 mass%	0.2 mass%
Si:	0.1 mass%	0.15 mass%
Fe:	0.2 mass%	0.3 mass%
Balance:	Al and unavoidable impurities	Al and unavoidable impurities

(D) Similarly, when a consideration is given to the closest alloy composition of "Al-Si braze alloy" in the invention according to Claim 1 of the Patent from the specific alloy composition of "braze material" described in A-2 in view of the general concept of the above alloy (B), it is No. E, and the composition is set forth below (paragraph [0037], Table 3).

Si: 10 mass%
Mg: 1.4 mass%
In: 0.1 mass%
Sn: 0.1 mass%
Fe: 0.3 mass%
Balance: Al and unavoidable impurities

(E) For the above reasons, it can be said that A-2 describes the following invention (hereinafter referred to as "Invention A-2".):

"An aluminum alloy clad material for heat exchanger, in which a braze material is cladded at least on a side of an interlayer material of a bilayer structure of a core material and the interlayer material, said core material is composed of aluminum alloy containing Mn, Cu, Mg, Ti, Si, and Fe and a balance of Al and unavoidable impurities,

said interlayer material is an aluminum alloy (i) containing
Zn: 3%,
Cu: 0.2%,
Mg: 0.6%,
Ti: 0.1%,
Si: 0.1%,
Fe: 0.2%, and
a balance of Al and unavoidable impurities, or
an aluminum alloy (ii) containing
Zn: 6%,
Cu: 0.45%,
Mg: 0.85%,
Ti: 0.2%,
Si: 0.15%,
Fe: 0.3%, and
a balance of Al and unavoidable impurities,
said braze material is composed of aluminum alloy comprising Si,
and containing Si: 10%,
and further contains Mg: 1.4%,
In: 0.1%,
Sn: 0.1%,
Fe: 0.3%, and
a balance of Al and unavoidable impurities."

5 Judgment by the body

The body has determined that the patents according to Claims 1 to 16 cannot be revoked for the reasons and evidences submitted by the Opponent in the Opposition to the granted patent.

The summary of the reason is that in an aluminum brazing sheet in the inventions according to Claims 1 to 16 of the Patent, an alloy composition of interlayer material increases the Mg amount, whereas an alloy composition decreases the Mg amount and contains Bi. None of Evidence A No. 1 and A No. 2 describes or suggests these points.

Hereinafter, a consideration is given to (1) Comparison with the invention described in Evidence A No. 1 and then (2) Comparison with the invention described in Evidence A No. 2 to explain that the inventions according to Claims 1 to 16 of the Patent were not easily conceivable.

(1) Comparison with the invention described in Evidence A No. 1

A The invention according to Claim 1 of the Patent

(A) The invention according to Claim 1 of the Patent (as per the above 2.) and the A-1 invention (as per the above 4(1)B(E)) are compared.

In the latter, "aluminum alloy clad material for heat exchanger" is used for braze joint (paragraph [0001]) and a clad material is subjected to cold rolling and final annealing to obtain a clad sheet (paragraph [0054]), and thus it corresponds to the former "aluminum alloy brazing sheet".

The amounts of Si, Fe, Cu, and Zn in the latter "interlayer material" fall within ranges of Si, Fe, Cu, and Zn in "aluminum alloy" of the former "interlayer material".

The amounts of Si, Bi, and Fe in the latter "aluminum alloy" for "clad material 1" fall within ranges of Si, Bi, and Fe in the former "Al-Si braze alloy".

The latter "interlayer material having a sacrificial positive electrode effect on the core material" corresponds to the former "said interlayer is sacrificial to the core".

Therefore, the inventions have the following corresponding feature and different features:

(Corresponding Feature)

"An aluminum alloy brazing sheet suitable for brazing to other components for flux-free brazing, wherein said aluminum alloy brazing sheet comprises an aluminum alloy core material covered with an interlayer of aluminum alloy comprising

0.2 wt% Si,

0.1 wt% Cu,

0.2 wt% Fe,

3.0 wt% Zn, and

unavoidable impurities and aluminum, wherein an interlayer is covered with a braze alloy comprising

10.0 wt% Si,

0.1 wt% Bi,

0.3 wt% Fe, and

unavoidable impurities and aluminum, and said interlayer is sacrificial to the core".

(Different Feature 1)

Regarding the alloy composition of the interlayer material, the invention according to Claim 1 of the Patent comprises "0.2 to 2.5 wt% Mg", "<2.0 wt% Mn", "≤0.2 wt% Ti", "≤0.1 wt% Sn", "≤0.1 wt% In", "≤0.2 wt% in total of Zr, Cr, V, and/or Sc" and "a plurality of unavoidable impurities with a total content of impurities of less than 0.2 wt%, each impurity being in an amount of less than 0.05 wt%", whereas the A-1 invention comprises "0.10 mass% Mg", and the remaining constituents are indefinite.

(Different Feature 2)

Regarding the alloy composition of braze material, the invention according to Claim 1 of the Patent is "Al-Si braze material" comprising "<0.02 wt% Mg", " ≤6 wt% Zn", " ≤0.1 wt% Sn", " ≤0.1 wt% In", " ≤0.3 wt% Cu", "≤0.15 wt% Mn", "≤0.05 wt% Sr" and "a plurality of unavoidable impurities with a total content of impurities of less than 0.2 wt%, each impurity being in an amount of less than 0.05 wt%", whereas the A-1 invention is an "aluminum alloy" in which the amounts of are unknown.

(Different Feature 3)

The invention according to Claim 1 of the Patent "comprises a core material and an interlayer, each having a melting point higher than that of a braze alloy, whereas the A-1 invention fails to specify as such.

(B) Different features

A consideration is given to Different Feature 1.

In the interlayer material according to the A-1 invention, an element to be added to a publicly known sacrificial positive electrode material may be, for example, 3.0% or less Mg (A-1, paragraph [0042]).

Further, Mg of interlayer material according to the A-2 invention functions to improved strength of interlayer material, and its preferable range is 0.55% to 0.9% (A-2, paragraph [0023]) and specific compositions of 0.6% to 0.85% Mg are described (A-2 paragraph [0036], Table 2). Comprehensively taking these into account, there is no motivation to adjust an amount of Mg of interlayer material of the A-1 invention to a range of "0.2 to 2.5 wt%" of the Invention in place of 0.10%.

On the other hand, Mg of the interlayer in the invention according to Claim 1 of the Patent diffuses through a braze layer into an outer surface of braze during the heating up to a brazing temperature, and if an appropriate amount of Mg reaches there in a proper time, a joint part may be formed (the patent specification, paragraphs [0026] and [0028]). Further, the effects of the interlayer in the invention according to Claim 1 of the Patent having "0.2 to 2.5 wt% Mg" are supported by a result of visual inspection of the braze joint part (the patent specification, paragraphs [0045] to [0047], Table 1, Table 2).

Further, such matters are neither described nor suggested in A-1 or A-2.

Therefore, even a person skilled in the art could not have easily conceived of adjusting an amount of Mg to "0.2 to 2.5 wt%" as an alloy composition of an interlayer material in the A-1 invention.

(C) Summary of the invention according to Claim 1 of the Patent

For the above reasons, without considering Different Features 2 and 3, the invention according to Claim 1 of the Patent was not easily conceivable by a person skilled in the art on the basis of the A-1 invention and the description of A-2.

B The inventions according to Claims 2 to 16 of the Patent

(A) The inventions according to Claims 2 to 12 of the Patent specify an interlayer, a core material, Al-Si braze alloy, and an aluminum alloy brazed sheet by directly or indirectly depending from Claim 1.

Therefore, similarly to the reasons shown in the above A, the inventions according to Claims 2 to 12 of the Patent were not easily conceivable by a person skilled in the art on the basis of the A-1 invention and the description of A-2.

(B) The inventions according to Claims 13 to 16 of the Patent specify a brazed product, a method of brazing a heat exchanger, and the use of the heat exchanger and the use of an aluminum alloy brazed sheet by directly or indirectly depending from Claim 1.

Therefore, similarly to the reasons shown in the above A, the inventions according to Claims 13 to 16 of the Patent were not easily conceivable by a person skilled in the art on the basis of the A-1 invention and the description of A-2.

(2) Comparison with the invention described in Evidence A No. 2

A The invention according to Claim 1 of the Patent

(A) The invention according to Claim 1 of the Patent (as per the above 2.) and A-2 invention (as per the above 4(2)B(E).) are compared with each other.

The latter "aluminum alloy clad material for heat exchanger" is used for a material of a working fluid channel of a heat exchanger to be jointed by brazing (paragraph [0001]) and a clad material is subjected to cold rolling and final annealing to obtain an aluminum alloy clad sheet (paragraph [0034]), and thus it corresponds to the former "aluminum alloy brazing sheet".

All the amounts of Si, Mg, Cu, Fe, Zn, and Ti in the latter "aluminum alloy" for "interlayer material" fall within ranges of Si, Mg, Cu, Fe, Zn, and Ti in "aluminum alloy" of the former "aluminum alloy" of "interlayer".

All the amounts of Si, In, Sn, and Fe in the latter "aluminum alloy for braze material" for "clad material" fall within ranges of Si, In, Sn, and Fe in the former "Al-Si braze alloy".

Zn contained in the latter "interlayer material" "imparts an excellent sacrificial positive electrode effect on the core material to an interlayer material" (A-2, paragraph [0026]) and thus corresponds to the former "said interlayer is sacrificial to the core".

Therefore, the inventions have the following corresponding feature and different features:

(Corresponding Feature)

"An aluminum alloy brazing sheet suitable for brazing to the other components for flux-free brazing, wherein said aluminum alloy brazing sheet comprises an aluminum alloy core material covered with an interlayer of the aluminum alloy (i) comprising

Si: 0.1%,
Mg: 0.6%,
Fe: 0.2%,
Cu: 0.2%,
Ti: 0.1%,
Zn: 3% and Al and unavoidable impurities, or

the aluminum alloy (ii) comprising

Si: 0.15%,
Mg: 0.85%,
Fe: 0.3%,
Cu: 0.45%,
Ti: 0.2%,
Zn: 6% and Al and unavoidable impurities, wherein an interlayer is composed of

aluminum alloy comprising Si,

comprising Si: 10%, and further

In: 0.1%,

Sn: 0.1%,

Fe: 0.3%, and being covered with a braze alloy comprising Al and unavoidable impurities,

and said interlayer is sacrificial to the core.".

(Different Feature 4)

Regarding the alloy composition of interlayer, the invention according to Claim 1 of the Patent comprises "<2.0 wt% Mn", "≤0.1 wt% Sn", "≤0.1 wt% In", "≤0.2 wt% in total of Zr, Cr, V and/or Sc" and "a plurality of unavoidable impurities with a total content of impurities of less than 0.2 wt%, each impurity being in an amount of less than 0.05 wt%", whereas in the A-2 invention the amounts of them are indefinite in both the alloy composition of (i) and the alloy composition of (ii).

(Different Feature 5)

Regarding the alloy composition of braze material, the invention according to Claim 1 of the Patent is "Al-Si braze alloy" comprising "<0.02 wt% Mg", "0.01 to 1.0 wt% Bi", " ≤6 wt% Zn", " ≤0.3 wt% Cu", " ≤0.15 wt% Mn", " ≤0.05 wt% Sr", and "a plurality of unavoidable impurities with a total content of impurities of less than 0.2 wt%, each impurity being in an amount of less than 0.05 wt%", whereas the A-2 invention is an "aluminum alloy" with "Mg: 1.4%", and unknown amounts of the remaining constituents.

(Different Feature 6)

The invention according to Claim 1 of the Patent "comprises a core material and an interlayer, each having a melting point higher than that of a braze alloy", whereas the A-2 invention fails to specify as such.

(B) Different features

In view of matters of the case, Different Feature 5 is examined.

A-2 describes in paragraph [0028] the use of a braze material of an Al-Si-Mg-based alloy containing 0.2 to 2.0% Mg in a case of vacuum brazing, and the use of a braze material of an Al-Si-based alloy in a case of flux brazing. Thus aluminum alloy for braze material according to the A-2 invention is a braze material of Al-Si-Mg-based alloy.

Even if the braze material in the A-2 invention should be altered from Al-Si-Mg-based alloy to Al-Si-based alloy, it is still indefinite that the altered braze material would contain "<0.02 wt% Mg" as an unavoidable impurity. First of all, since the A-2 invention relates to "flux brazing," it would not relate to "flux-free brazing" as the invention according to Claim 1 of the Patent.

In this regard, according to paragraph [0043] of A-1, Al-Si-based alloy or Al-Si-Mg-based alloy, which is commonly used as braze material, is used for the clad material 1 and the content of Mg is 0.1 to 2.0%. However, similarly to the above A-2, it is still indefinite that the altered clad material of Al-Si-based alloy would contain "<0.02 wt% Mg" as an unavoidable impurity.

Further, A-2 only describes that even the use of braze material including Bi does not spoil the effect of the invention. It neither describes nor suggests specifying the content of Bi. In this regard, A-1 also describes in paragraph [0043] that 0.001 to 0.2% Bi may be contained as necessary.

As a result, comprehensively taking into account the descriptions of A-1 and A-2, there is no motivation to specify the Mg amount as "<0.02 wt%" and the Bi amount as "0.01 to 1.0 wt%" with regard to the composition of aluminum alloy for braze material according to the A-2 invention.

On the other hand, it is important that the Al-Si braze alloy in the invention according to Claim 1 of the Patent should maintain the low Mg content in a thin braze layer for excellent brazing. Further, the addition of Bi to a braze layer reinforces and rapidly forms a joint part, and brings a bigger joint part (the patent specification, paragraph [0029]). The effects of the Al-Si braze alloy of the invention according to Claim 1 of the Patent having "<0.02 wt% Mg" and "0.01 to 1.0 wt% Bi" is supported by the result of visual inspection of the braze joint part (the patent specification, paragraphs [0045] to [0047], Table 1, Table 2).

Such matters are neither described nor suggested in A-1 or A-2.

Accordingly, even a person skilled in the art could not have easily conceived of adjusting an amount of Mg to <0.02 wt%" and an amount of Bi to "0.01 to 1.0 wt%" as a composition of Al-Si braze alloy in the A-2 invention.

(C) Summary of the invention according to Claim 1 of the Patent

For the above reasons, without examining Different Features 4 and 6, the invention according to Claim 1 of the Patent was not easily conceivable by a person skilled in the art on the basis of the A-2 invention and the description of A-1.

B The inventions according to Claims 2 to 16 of the Patent

(A) The inventions according to Claims 2 to 12 of the Patent specify an interlayer, a core material, an Al-Si braze alloy, and an aluminum alloy brazed sheet by directly or indirectly depending from Claim 1.

Therefore, similarly for the reasons shown in the above A, the inventions according to Claims 2 to 12 of the Patent were not easily conceivable by a person skilled in the art on the basis of the A-2 invention and the description of A-1.

(B) The inventions according to Claims 13 to 16 of the Patent specify a brazed product, a method of brazing heat exchanger, and the use of the heat exchanger and the use of an aluminum alloy brazed sheet by directly or indirectly depending from Claim 1.

Therefore, similarly for the reasons shown in the above A, the inventions according to Claims 13 to 16 of the Patent were not easily conceivable by a person skilled in the art on the basis of the A-2 invention and the description of A-1.

(3) Summary

For the above reasons, the inventions according to Claims 1 to 16 of the Patent were not easily conceivable by a person skilled in the art on the basis of the inventions described in Evidence A No. 1 to No. 2.

6 Closing

The patents according to Claims 1 to 16 cannot be revoked for the reasons and evidences submitted by the Opponent in the Opposition to the granted patent.

Further, there is no other reason to revoke the Patent according to Claims 1 to 16.

Therefore, a decision shall be made as described in the conclusion.

August 22, 2019

Chief administrative judge: IKEFUCHI Ryu
Administrative judge: NAKAZAWA Noboru
Administrative judge: HIRATSUKA Masahiro