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Datasheet for the decision of 4 March 2009

Case Number: T 0988/07 - 3.3.09

Application Number: 01906053.2

Publication Number: 1268190

IPC: B32B 15/01

Language of the proceedings: EN

Title of invention:
Improved electrical conductivity and high strength aluminium alloy composite material and methods of manufacturing and use

Applicant:
Aleris Aluminum Canada LP

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123

Relevant legal provisions (EPC 1973):
-

Keyword:
"Novelty (yes - after amendment)"
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

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Case Number: T 0988/07 - 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 4 March 2009

Appellant: Aleris Aluminum Canada LP
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 28 December 2006 refusing European application No. 01906053.2 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: P. Kitzmantel
Members: J. Jardón Álvarez
K. Garnett

Summary of Facts and Submissions

I. This appeal lies from the decision of the Examining Division, announced orally on 16 November 2006 and issued in writing on 28 December 2006, refusing European patent application No. 01 906 053.2, published as WO - 01/56782 (EP - 1 268 190).

II. The decision under appeal was based on a main request filed with letter dated 14 July 2006 and a first auxiliary request filed on 16 November 2006 during the oral proceedings before the Examining Division.

Claim 1 of the main request read as follows:

"1. An aluminium alloy composite comprising:

(a) a core layer having opposing core surfaces and being formed from a first aluminium alloy material, selected from one of an AA3000 series, an AA6000 series and an AA8000 series aluminium alloy, having less than 99% by weight of aluminium and more than 1% by weight of one or more metallic elements, the one or more metallic elements being in or out of solution and increasing the strength of the first aluminium alloy material such that the first aluminium alloy material has a tensile strength greater than 103.4 MPa, and having an electrical conductivity less than 50% IACS; and

(b) at least one cladding layer having opposing surfaces, one of the opposing surfaces adjacent one the opposing core surfaces, with at least a portion of the other opposing surfaces exposed for fusing with another aluminium component, the at

least one cladding layer being formed of a second aluminium alloy material, of an AA1000 series aluminium alloy, having less than 1% by weight of the one more metallic elements such that the second aluminium alloy material has a tensile strength less than 103.4 MPa, and may have from zero to up to 2.5% by weight of other metallic elements that are in solution and increase corrosion potential negativity so that the corrosion potential of the second aluminium alloy material is at least 20 mV more negative than a corrosion potential of the first aluminium alloy material of the core layer, and having an electrical conductivity greater than 50% IACS."

As compared to the main request Claim 1 of the auxiliary request contained several amendments including the definition of the metallic members of the second aluminium alloy material being: "less than 1% by weight of the one or more of metallic elements selected from the group comprising Cr, Cu, Fe, Mg, Mn, Ni, Co, Si, Li, Ti, V, Zr and Zn."

III. The following documents are referred to in the present decision:

D2: US - 4 560 625

D3: US - 4 172 181 and

D6: US - 5 148 862

IV. The Examining Division found no support in the application as originally filed for the features

"allowing the AA1000 series alloy referred to feature b) of claim 1 to have up to 2.5% by weight of other metallic elements" (main request) and "less than 1% by weight of the one **or** more **of** the metallic elements **selected from the group comprising Cr, Cu, Fe, Mg, Mn, Ni, Co, Si, Li, Ti, V, Zr and Zn**" (auxiliary request 1, emphasis by the Examining Division). Consequently, the Examining Division refused the application because it did not fulfil the requirements of Article 123(2) EPC.

The Examining Division further concluded that the subject-matter of Claim 1 of the main request lacked novelty having regard to the disclosure of document D2 and that the subject-matter of Claim 1 of the auxiliary request, although novel, lacked inventive step over the disclosure of the same document. The only documents cited in the decision were D2 and D3.

V. Notice of Appeal was filed on 30 January 2007 and the appeal fee was paid on the same day. The Statement setting out the Grounds of Appeal was filed on 7 May 2007.

With the Statement setting out the Grounds of Appeal, the Appellant filed sets of claims for seven requests, namely a main request and six auxiliary requests.

VI. On 12 September 2008 the Board dispatched the summons to attend oral proceedings. In the annexed communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal, the Board expressed its preliminary opinion on the case.

VII. With letter dated 30 January 2009, the Appellant filed an amended main request and new auxiliary requests 1 to 6 to replace the requests on file.

VIII. During the oral proceedings held on 4 March 2009, after the discussion of novelty and inventive step, the Appellant withdrew all its previous requests, except its second auxiliary request.

Claim 1 of this sole request reads:

"1. Use of an aluminium alloy composite as bare heat exchanger fin stock material, the aluminium alloy composite comprising:

(a) a core layer having opposing core surfaces and being formed from a first aluminium alloy material having less than 99% by weight of aluminium and more than 1% by weight of metallic elements selected from the group containing Cr, Cu, Fe, Mg, Mn, Ni, Co, Si, Li, Ti, V, Zr and Zn, the one or more metallic elements being in or out of solution and increasing the strength of the first aluminium alloy material such that the first aluminium alloy material has a tensile strength greater than 103.4 MPa, and having an electrical conductivity less than 50% IACS;

(b) at least one cladding layer having opposing surfaces, one of the opposing surfaces adjacent one the opposing core surfaces, with at least a portion of the other opposing surfaces exposed for fusing with another aluminium component, the at least one cladding layer being formed of a second aluminium alloy material having less than 1% by

weight of metallic elements selected from the group containing Cr, Cu, Fe, Mg, Mn, Ni, Co, Si, Li, Ti, V and Zr such that the second aluminium alloy material has a tensile strength less than 103.4 MPa, and containing metallic additions of up to 2.5% by weight of other metallic elements selected from the group containing Ga, In and Zn that are in solution and increase corrosion potential negativity so that the corrosion potential of the second aluminium alloy material is at least 20 mV more negative than a corrosion potential of the first aluminium alloy material of the core layer, and having an electrical conductivity greater than 50% IACS."

IX. The arguments put forward by the Appellant can be summarized as follows:

– The Appellant pointed out that the composite materials disclosed in D2 and D3 were not used as fin stock material but as material for radiator header tubes and for this reason had to fulfil quite different requirements. The Appellant regarded D6 as closest prior art, a document disclosing an aluminium alloy fin material for use in an aluminium heat exchanger made of an aluminium alloy of the AA7xxx-series having a composition of 0.8 to 1.8 weight percent Fe, 0.3 to 3.0% Zn, up to 0.3% Cu and at least one element selected from the group consisting of 0.05 to 0.25% Zr and 0.05 to 0.25% Cr, with the balance being aluminium and inevitable impurities.

– The Appellant saw the problem to be solved by the application as being to provide a fin stock material with improved electrical/thermal conductivity, sagging resistance, high strength, excellent corrosion and good brazeability.

– In its opinion it would not be obvious for the skilled person to replace the one-layer fin stock material disclosed in D6 by a composite material according to D2 and D3, in particular because he would be concerned that the thermal conductivity of such fin stock material would be lower than the thermal conductivity of a fin stock material consisting only of the AA7xxx-series alloy of D6.

X. The Appellant requested that the decision under appeal be set aside and a patent be granted on the basis of Claims 1 to 7 of the second auxiliary request filed with the letter dated 30 January 2009.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments (Article 123(2) EPC)*

2.1 The amendments made to the claims are supported by the original disclosure, the published WO - 01/56782:

2.1.1 Claims 1 to 7 correspond to Claims 1 to 7 of the application as originally filed reformulated as use claims. The subject-matter of the claims is now directed to the use of the aluminium alloy composites

as bare fin stock material for heat exchangers in accordance with the preferred use disclosed for instance on page 3, lines 7 - 8 of the application as filed.

2.1.2 Additionally, the following amendments have been made to Claim 1:

– The general expressions "one or more metallic elements", "the one more metallic elements" and "other metallic elements" used in Claim 1 as filed have been specified in accordance with the disclosure of page 6, line 27 to page 7, line 16 (see page 6, line 30 for the core layer and page 7, lines 5 to 14 for the cladding layer), and

– the expression "having from zero to up to 2.5% by weight of ..." has been amended to read "and containing metallic additions of up to 2.5% by weight of ..." to overcome a clarity objection. The deletion of the value "zero" from the original disclosure does not add subject-matter to the claims.

2.2 The Examining Division refused the application because in its opinion certain amendments of the claims then pending were not supported by the application as originally filed (see above, point IV). As none of the amendments objected to by the Examining Division is present in the claims now under consideration, no further comments are needed in this respect.

2.3 Therefore, the subject-matter of the claims meets the requirements of Article 123(2) EPC.

3. *Novelty (Article 54 EPC)*

3.1 The Examining Division denied the novelty of the subject-matter of the then pending main request because in its opinion document D2 disclosed aluminium alloys having all the features of the claimed composites. Since the present claims are no longer directed to an aluminium alloy composite as such these objections no longer apply.

3.2 Claim 1 is directed to the use of an aluminium alloy composite as fin stock material, the composite comprising essentially:

- a core layer from a first aluminium alloy material having a tensile strength greater than 103.4 MPa and an electrical conductivity less than 50% IACS; and
- at least one cladding layer formed of a second aluminium alloy having a tensile strength less than 103.4 MPa, an electrical conductivity greater than 50% IACS and a corrosion potential at least 20 mV more negative than the corrosion potential of the first aluminium alloy.

3.3 None of the available documents discloses the use of such composites as fin stock material.

Documents D2 and D3 disclose aluminium alloy composite materials comprising a core layer and a clad layer but neither of them mentions their possible use as fin material, but rather as material for radiator header tubes (see D2, Claim 1; see also column 1, lines 16 to 18 and column 4, lines 29 to 32, and D3, Claim 3, and

column 3, lines 41 - 45, Figures 1 and 2 in combination with column 5, lines 20 to 29).

3.4 The subject-matter of Claim 1 is thus novel.

4. *Inventive step (Article 56 EPC)*

4.1 Closest prior art

4.1.1 As mentioned above, documents D2 and D3 disclose aluminium alloy composite materials suitable for the manufacture of radiator tubings. Although these are parts of heat exchangers their function is quite different from those of the fins mechanically connecting the tube assemblies and consequently the alloys they are made of have to fulfil different requirements. The main difference is that the alloys of the tubes are in contact with the coolant flowing through them (water in the case of car radiators), making corrosion resistance against water a very important requirement. On the other hand, fin stock materials are used for the lamella joining the tubes together and their thermal/electrical conductivity is therefore a very important feature for the overall performance of the heat exchanger assembly.

As a consequence, the different use of the composites of D2 and/or D3 renders these documents unsuitable as starting points for the assessment of inventive step of the currently claimed use.

4.1.2 The Appellant regarded document D6 as the closest prior art document since it relates, like the application, to a fin stock material. The Board has no reason to disagree with the Appellant.

As explained in the introduction of D6, Al-Mn alloys such as AA3003 alloy or AA3202 alloy have been extensively used as fin stock material in heat exchangers (see column 1, lines 49 - 60). When the thickness of the fins is reduced (in order to save weight) the cross section through which heat flux transfers is reduced and problems arise with the heat-transfer efficiency when these Al-Mn alloys are used (cf. D6, column 2, lines 49 - 66). To overcome these drawbacks and to obtain fin materials having both good tensile strength and thermal conductivity several modifications of the Al-Mn alloy have been proposed in the prior art.

4.1.3 To tackle this problem D6 proposes the use of an aluminium alloy fin material consisting of 0.8 to 1.8% Fe in weight percent, 0.3 to 3.0% Zn, up to 0.3% Cu and at least one element selected from the group consisting of 0.05 to 0.25% Zr and 0.05 to 0.25% Cr, with the balance being aluminium (see Claim 1). The fin material is said to have improved thermal conductivity after brazing, together with high strength, as compared with fin materials made of conventional Al-Mn alloys (see column 3, lines 14 - 21). There is however still a need for fin stock material combining both high levels of strength and electrical conductivity.

4.2 Problem and solution

4.2.1 The technical problem to be solved by the application can be formulated as being to provide a further, alternative material suitable as fin stock material having both high tensile strength, high electrical/thermal conductivity as well as good corrosion resistance and brazeability (see page 3, lines 5 - 7 of the application).

4.2.2 This problem is solved according to Claim 1 by adding to a core layer of high tensile strength and low electrical conductivity (an AA3000 series or similar alloy) at least one cladding layer of high electrical conductivity and relatively low strength. In this way a composite material is formed which combines the attributes of the higher strength material of the core layer, namely improved resistance to high temperature deformation and sagging, with the high electrical/thermal conductivity of the cladding layer.

4.2.3 The results in the specification demonstrate that this objective has been attained. The examples and comparative examples in the application show that the electrical and thereby the thermal conductivity of the composites of the invention are considerably higher than the electrical conductivity of the core material itself (see Table 2). The bare fin stock material exhibits a good balance of post-braze electrical conductivity, corrosion resistance, and strength (see Table 4).

4.3 Obviousness

4.3.1 There is no hint to this solution in the cited prior art. As pointed out in paragraph 4.1.1, the composites disclosed in documents D2 and D3 used for heat exchanger tubings are designed to meet different properties.

There is also no hint in D6 at the present solution. While both D6 and the claimed invention address the deficiencies of fins stocks made of AA3003 alloy, the solution of D6, namely to modify the alloy composition, is fundamentally different from the solution of the present invention, which is to keep this alloy as core material while adapting the properties of the composite by the cladding material specified in Claim 1.

4.4 For these reasons the subject-matter of Claim 1 and, in view of their dependency, also the subject-matter of dependent Claims 2 to 7 fulfil the requirements of Article 56 EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the Examining Division with the order to grant a patent on the following basis:

   (a) Claims 1 to 7 of the second auxiliary request filed with the letter dated 30 January 2009;

   (b) Figures 1 to 5 as originally filed;
   after any necessary consequential adaptation of the description.

The Registrar: The Chairman:

G. Röhn P. Kitzmantel