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**Datasheet for the decision
of 15 October 2009**

Case Number: T 0366/08 - 3.2.08

Application Number: 99963592.3

Publication Number: 1153152

IPC: C22C 21/06

Language of the proceedings: EN

Title of invention:

Method for the manufacturing of an aluminium-magnesium-lithium alloy product

Patentee:

Aleris Aluminum Koblenz GmbH

Opponent:

ALCAN FRANCE S.A.S.

Headword:

-

Relevant legal provisions:

EPC Art. 56, 84

Relevant legal provisions (EPC 1973):

-

Keyword:

"Inventive step (no) - main request, auxiliary requests 1, 3 and 4"

"Clarity (no) - auxiliary request 2"

Decisions cited:

-

Catchword:

-



Case Number: T 0366/08 - 3.2.08

DECISION
of the Technical Board of Appeal 3.2.08
of 15 October 2009

Appellant: ALCAN FRANCE S.A.S.
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Respondent: Aleris Aluminum Koblenz GmbH
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 18 December 2007
rejecting the opposition filed against European
patent No. 1153152 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: T. Kriner
Members: R. Ries
E. Dufrasne

Summary of Facts and Submissions

I. Opposition was filed by the present appellant against the entire European patent No. 1 153 152 and based on Article 100(a) EPC 1973 (lack of inventive step). The opposition division decided that the patent met the requirements of the EPC and rejected the opposition accordingly. The decision was notified on 18 December 2007.

II. On 15 February 2008, the appellant (opponent) lodged an appeal against the decision and the fee for the appeal was paid on the same date. The statement setting out the grounds of appeal was received on 28 April 2008.

In support of his submissions, the appellant referred, amongst others, to the following documents:

D2: A. Haszler et al.: "Manufacturing Aspects of Rolled Aluminium-Lithium Semi-Fabricated Products", Aluminium-Lithium Conference 1991, Garmisch-Partenkirchen, pages 939 to 944, published 1992;
and

D11: WO-A-92/03583

III. Oral proceedings before the Board took place on 15 October 2009 at the end of which the following requests were made:

The appellant requested that

- the decision under appeal be set aside and
- the European patent No. 1 153 152 be revoked.

The respondent (patent proprietor) requested that

- the appeal be dismissed or, in the alternative,
- the decision under appeal be set aside and the patent be maintained on the basis of one of the auxiliary request 1, filed with letter dated 14 September 2009, or auxiliary requests 2 to 4, filed during the oral proceedings.

Independent claim 1 as granted reads as follows:

"1. Method for manufacturing of an aluminium-magnesium-lithium product, comprising the steps of subsequently:

(a) providing an aluminium alloy consisting of (in weight %):

Mg	3.0 – 6.0
Li	0.4 – 3.0
Zn	up to 2.0
Mn	up to 1.0
Ag	up to 0.5
Fe	up to 0.3
Si	up to 0.3
Cu	up to 0.3

0.02 – 0.5 selected from the group consisting of

Sc	0.010 – 0.40
Hf	0.010 – 0.25
Ti	0.010 – 0.25
V	0.010 – 0.30
Nd	0.010 – 0.20
Zr	0.020 – 0.25
Cr	0.020 – 0.25
Y	0.005 – 0.20
Be	0.0002 – 0.10

balance consisting of aluminium and incidental impurities, each 0.05 max, total 0.15 max;

- (b) casting the aluminium alloy into an ingot;
- (c) preheating the ingot;
- (d) hot rolling the preheated ingot to a hot worked intermediate product;
- (e) cold rolling the hot worked intermediate product to a rolled product in both the length and in the width direction with a total cold rolling reduction of at least 15%;
- (f) solution heat treating the cold rolled product in the temperature range of 465 to 565°C for a soaking time in the range of 0.15 to 8 hours;
- (g) cooling the solution heat treated product from the solution heat treatment temperature to below 150°C with a cooling rate of at least 0.2 °C/sec;
- (h) ageing the cooled product to provide a sheet or thin plate product having a minimum yield strength of 260 MPa or more and a minimum tensile strength of 400 MPa or more in at least the L- and LT-direction, a minimum yield strength of 230 MPa or more and a minimum tensile strength of 380 MPa or more in the 45° to the L-direction, and further having a minimum T-L fracture toughness K_{IC} of 80 MPa√m or more for 400 mm wide Centre Cracked Fracture Toughness Test-panels."

Claim 1 of the first auxiliary request differs from claim 1 as granted by the amendments marked by bold letters:

"1. Method for...

- (d) hot rolling the preheated ingot

- d1) in both the length and in the width direction** to a hot worked intermediate product;
- (e) cold rolling the hot worked intermediate product to a rolled product
 - e1) in both the length and the width direction**
 - e2) with a total cold rolling reduction of at least 15%; ...**
- (h) ageing the cooled product to provide a sheet or a thin plate product having
 - h1) a minimum yield strength of 260 MPa or more and**
 - h2) a minimum tensile strength of 400 MPa or more in at least the L**
 - h3) and LT-direction,**
 - h4) a minimum yield strength of 230 MPa or more and**
 - h5) a minimum tensile strength of 380 MPa or more in the 45° to the L-direction, and further**
 - h6) having a minimum T-L fracture toughness K_{IC} of 80 MPa \sqrt{m} or more for 400 mm wide Centre Cracked Fracture Toughness Test-panels."**

Claim 1 of the second auxiliary request differs from claim 1 as granted by the amendments marked by bold letters:

"1. Method for...

- (d) hot rolling the preheated ingot
 - d1) in both the length and in the width direction** to a hot worked intermediate product; **wherein**
 - d2) the intermediate hot rolled product is reheated to a temperature in the range of**

360°C to 470°C for 1 to 24 hours after the initial first hot rolling step; and this reheat treatment is repeated for each following step of hot rolling until the desired intermediate gauge is obtained

- (e) cold rolling the hot worked intermediate product to a rolled product
 - e1)** in both the length and the width direction
 - e2)** with a total cold rolling reduction of at least 15%;
- (h) ...Test-panels."

Claim 1 of the third auxiliary request differs from claim 1 of the second auxiliary request by the amendments marked by bold letters:

"1. Method for...

- d) hot rolling the preheated ingot
 - d1) in both the length and in the width direction to a hot worked intermediate product; **and**
 - d2) wherein the product has, after the final hot rolling step, a temperature above 270°C,...**
- (g) cooling..0.2°C/s;
- (g2) stretching the cooled product by an amount not greater than 3% of its original length; and**
- (h) ageing the cooled product to provide a sheet or a thin plate product having a minimum yield strength of **330** MPa or more and a minimum tensile strength of **430** MPa or more... Test-panels."

Claim 1 of the fourth auxiliary differs from claim 1 of the third auxiliary request by the amendments marked by bold letters):

"1. Method for...

(c) preheating the ingot **for 5 to 15 hours at a temperature in the range of 400 to 470°C.**

(d) hot rolling...hours;

(g) **air cooling** the solution heat treated product ...of at least 0.2°C/sec;

(h) ageing... Test panels"

IV. The appellant's arguments are summarized as follows:

Document D11 as the closest prior art described the same Al-Mg-Li alloy and the same process steps as claimed, except for the step (e) of cold rolling the intermediate hot rolled product *in the length and the width direction.*

Starting from D11, the objective problem to be solved by the claimed process resided in providing a method for reducing the anisotropy of the mechanical properties in the length and traverse direction caused by the existence of the rolling texture. The skilled person was, however, well aware of the fact that cross rolling in the length and traverse direction generally minimized anisotropy. Specifically with respect to Al-Li semi-fabricated products, document D2 taught a manufacturing route including either or both hot cross rolling and cold cross rolling to attenuate anisotropy like differences between the mechanical properties in the L- and LT-directions. It would have been obvious for the skilled person to transfer the teaching of D2

to the process for producing Al-Mg-Li sheet material of D11 to solve the identified problem. The fact that D2 was concerned with the Al-Cu-Mg-Li alloys (AA8090) or Al-Cu-Li-Zr alloys (AA2090) had no bearing on the matter, since these alloys and the one of D11 all belonged to the same family of Al-Li-alloys which were used in the aerospace field.

The mechanical properties like the yield strength (YS), tensile strength (TS) and fracture toughness featuring in step (h) of claim 1 were an inherent consequence of the selected alloy composition and the process parameters set out in steps (a) to (h). Therefore, they did not represent per se independent technical features.

As to the second auxiliary request the term "after the initial first hot rolling step" was open to interpretation and therefore unclear in its meaning. The amendment to claim 1 of the second auxiliary request therefore did not meet the requirement of clarity pursuant to Article 84 EPC. The additional technical features set out in claim 1 of the first to fourth auxiliary requests were either known from D11 or D2, respectively, or amounted to nothing more than common practice generally known and applied in the technical field of Al-Li alloys. The claimed process therefore did not involve an inventive step.

V. The respondent's arguments are summarized as follows:

Document D11 as the closest prior art disclosed an alloy composition within the claimed range in accordance with feature (a) as granted. However, this document did not show the step of preheating the ingot.

The preheating step in claim 1 of the patent could not be equated with the homogenization step in D11 which was carried out (i) for a different purpose and (ii) separate from the hot rolling step sometimes days or weeks before and (iii) for a time interval much longer than for a normal preheating step.

In addition, D11 neither disclosed cold rolling in both the length and width direction nor a total cold rolling reduction rate of at least 15%. It could be inferred from D11, page 10, lines 13 to 15 that cold rolling was merely mentioned as an optional step which was not applied in the example. Furthermore, the document did not address the problem of decreasing the anisotropy of the mechanical properties underlying the patent.

The overall performance of lithium containing alloys 2090 and 8090 referred to in document D11, pages 3 and 4 and having a composition different to that claimed in the patent, was unsatisfactory. In consequence thereof, the skilled person had no reason to turn to the process of D2 which was concerned with these alloys. Even if he did, he would have realized that hot "cross" rolling according the manufacturing process depicted in D2, Figure 1 meant rolling the ingot perpendicular to the casting direction rather than in the length and width direction as claimed. Hence "cross rolling" in D2 did not comply with the step "in the length and in the width direction" used in the patent. In any event, the fabrication steps set out in D2, Figure 1 did not include "cold cross rolling" at all, and no example was given showing cold rolling "in the length and width direction" as required by the claimed method. The

subject matter of claim 1 as granted thus involved an inventive step.

As to claim 1 of the first auxiliary request, D2 did not disclose the combination of both (i) hot rolling and (ii) cold rolling in the length and width direction to produce a more isotopic structure in the rolled product. Hence the process in claim 1 of the first auxiliary request was not obvious from D11 read in combination with D2.

With respect to feature d2) in claim 1 of the second auxiliary request, the meaning of the term "after the initial first hot rolling step" was clear. It was evident from the specification, e.g. [0049], example 1 and Table 2 that after hot rolling the ingot in the width direction (i.e. the initial first hot rolling step), the intermediate product was reheated and hot rolled in the length direction. The appellant's objection of lack of clarity was therefore unfounded.

Regarding claim 1 of the third auxiliary request, document D11 mentioned a temperature range for hot rolling, but was silent on the hot rolling finishing temperature. Thus D11 did not anticipate the final hot rolling temperature above 270°C as required in step d2). Moreover, the stretching carried out in the example on page 13 of D11 was 5 to 6% which was far above the upper limit of 3% stretch set out in step (g2). The process defined in claim 1 of the third auxiliary request was therefore not obvious from D11 and D2 either.

As to claim 1 of the fourth auxiliary request, neither D11 nor D2 disclosed a preheating step in the temperature range and time interval featuring in step (c). As previously mentioned, the homogenization treatment in the range of 343 to 498°C for about 20 hours specified for the process of D11 could not be compared with the preheating step (c), wherein the time interval was limited to 5 to 15 hours. A further distinction to the process of D11 and of D2 resulted from the term "air cooling the solution heat treated product" which implied a much lower cooling rate than obtained by "rapid" water quenching that was used e.g. in D11.

Vis-à-vis the disclosure of documents D11 and D2, the process featuring in claim 1 of all requests thus involved an inventive step.

Reasons for the Decision

1. The appeal is admissible.
2. Main request, claim 1 as granted; first auxiliary request;
 - 2.1 It was common ground to the parties and to the Board that document D11 qualifies as representing the closest prior art. Like the patent at issue, D11 discloses a method for producing aircraft and aerospace components of an aluminium-magnesium-lithium alloy which in its most preferred composition (in weight percent: 4.4% Mg, 1.8% Li, 0.5% Zn and 0.3 Ag, 0.14% Zr, the balance being Al) falls within the elemental ranges set out in

claim 1 of the patent at issue (see D11, page 8, lines 3 to 13). The method of D11 comprises the steps of:

- (b) casting an ingot of the AlMgLi-alloy (see D11, page 9, lines 4 to 8);
- (c) preheating the ingot prior to the principal working operation to a temperature ranging from 343 to 498°C for about 20 to 40 hours in order to dissolve soluble elements and to homogenize the structure of the metal (see D11, page 9, lines 18 to 31);
- (d) hot rolling the preheated ingot at a temperature between 371 to 510°C and optionally
- (e) cold rolling the hot worked intermediate product to provide further gauge reduction (see D11, page 10, lines 7 to 15);
- (f) solution heat treating the rolled product in the temperature range of 515 to 560°C for a soaking time of 0.25 to 5 hours;
- (g) cooling the solution heat treated product from the solution heat treatment temperature to 93°C or lower with a cooling rate higher than 38°C/sec (100°F/sec) (see D11, page 10, lines 17 to 29);
- (g2) stretching the product to minimize the loss in fracture toughness associated with the improvement of strength and
- (h) ageing the cooled product between 66 and 204°C, preferably 135 to 190°C for at least 30 min to provide a sheet or a thin plate product having the combination of fracture toughness and strength desired in aircraft members (see D11, page 11, lines 4 to 23).

2.2 During the oral proceedings, the respondent admitted that the mechanical properties specified in step (h) of

claim 1 are a direct result of the process steps (b) to (h) and, therefore, did not provide a technical distinction to the disclosure of D11.

Contrary to the respondent's position, the step of preheating the ingot is considered as being disclosed also in D11 for the following reasons. The homogenization treatment in D11 (343 to 498°C for about 20 hours) essentially corresponds to the preheating step (360 to 500°C/ 5 to 20 hours) set out in paragraph [0017] of the patent specification and aims at the same result, i.e. to dissolve soluble elements and to provide a homogenization effect before starting hot working. Moreover, hot rolling necessarily implies preheating the ingot to the hot-rolling temperature. Consequently, the claimed preheating step does not provide a patentable distinction to the process known from D11.

- 2.3 Document D11 does, however, not address the anisotropy of the mechanical properties in the length and traverse direction of the rolled product. As to claim 1 of the main request, D11 fails to disclose the step of cold rolling the hot worked intermediate product *"in both the length and in the width direction with a total reduction of at least 15%"* and with regard to claim 1 of the first auxiliary request of additionally *"hot rolling in both the length and in the width direction"*.

Starting from the technical disclosure of D11, the objective technical problem underlying the claimed process thus resides in providing AlMgLi rolled products exhibiting mechanical properties which are much more isotropic than the properties of products

manufactured in a coil production route (see the patent specification paragraphs [0015] and [0058]). This problem is solved by step (e) cold rolling the intermediate product "*in both the length and the width direction with a total reduction of at least 15%*" set out in claim 1 of the main request and additionally of both hot and cold rolling "*in both the length and in the width direction*" defined in claim 1 of the first auxiliary request.

The problem of anisotropy of the mechanical properties resulting from the "rolling texture" and how to cope with it has been generally known in the art. The skilled person, starting from the disclosure of D11 and looking for technical information how to solve the above mentioned problem would turn to D2, given that this document addresses the problem of anisotropy of the mechanical properties induced by rolling and in particular deals with manufacturing aspects of rolled Al-Li semi-fabricated products. Like the AlMgLi alloy used in the patent at issue and also in D11, the Al-Li alloys 8090 and 2090 tested in D2 belong to the same family of lithium containing Al-alloys which have achieved significant usage in the aerospace applications. Hence and contrary to the respondent's position, there is no reason from the compositional point of view for the skilled person to disregard the technical disclosure of document D2. As to the problem of anisotropy, document D2 recommends cross rolling during hot rolling (see D2, page 941, lines 6 to 4 from the bottom) and, more specifically, also during cold rolling (see D2, page 942, last three lines of the paragraph "cold rolling") as to reduce the differences

between the mechanical properties in the L- and LT- directions in the sheet products.

- 2.4 The respondent's argument that "cross rolling" in D2 did not necessarily mean "in the length and width direction" as claimed in the patent is not convincing. Figure 7 of document D2 describes "hot cross rolling" as rolling the "hot broad side" and the "hot longitudinal side" which means in the Board's understanding rolling in the length and width directions. This reading also applies to "cold cross rolling". The respondent's further reference to D2, Figures 1 and 7 which do not describe "cold cross rolling" is correct but misleading. Even if the fabrication steps depicted in Figures 1 and 7 only include hot cross rolling, document D2 clearly and unambiguously teaches the skilled reader in particular on page 941, lines 6 to 4 from the bottom and on page 942, the last three lines of the paragraph "cold rolling", that the optimal combination of cross rolling during hot rolling and, if required, also during cold rolling effectively reduces anisotropy.

As to the total cold reduction of at least 15% defined in claim 1, step (e) of the patent at issue, document D2 discloses on page 942, sub-paragraph "Pass Schedule" a cold rolling degree of 70% which is far above the claimed reduction rate. Besides, the patent at issue fails to prove by a convincing argument as to why a cold reduction rate of at least 15% is actually critical.

- 2.5 In view of these considerations, the subject matter of claim 1 of the main request and of the first auxiliary

request is obvious for a skilled person from the technical teaching given in documents D11 and D2 and, therefore, lacks inventive step.

3. Second Auxiliary request

Turning to feature d2) in claim 1 of the second auxiliary request, it remains unclear what the wording: reheating the intermediate hot rolled product "*after the initial first hot rolling step*" is actually supposed to define. On the one hand, this feature could be understood to represent the first pass when starting hot rolling. On the other hand, it could also mean that after a first sequence of passes in one direction for reducing the thickness by hot rolling the billet, the intermediate product undergoes reheating and thereafter, a second sequence of passes in another direction is carried out. The respondent's reference to paragraph [0049] of the specification describing one example of the claimed method cannot remove this ambiguity because the sequence of steps described therein represents only one possible interpretation of the term "*after the initial first hot rolling step.*" Since the patent specification does not give a clear and unambiguous meaning of the wording of feature d2) and thus there are serious doubts about what is to be defined by this feature, claim 1 of the second auxiliary request lacks clarity (Article 84 EPC).

4. Third auxiliary request

Compared to the first auxiliary request, claim 1 of the third auxiliary request additionally comprises the steps d2) and (g2). As to feature d2), document D11

teaches performing hot rolling at a temperature in the range of 371 to 510°C (700 to 950°F; see D11, page 10, second paragraph). Contrary to the respondents view, this inevitably implies a finishing hot rolling temperature within this range, i.e. of at least 371°C which is above 270°C set out in feature d2). Turning to feature (g2), stretching the solution heat treated and quenched alloy product before ageing is also taught in D11, page 11, lines 8 to 12. In the specific example given on page 13, lines 4 to 6 of document D11, the rolled sheet material is stretched between 5 and 6% which is well above the claimed upper limit of 3%, but the process disclosed in Figure 1 of document D2 generally includes a 2% stretching before artificial ageing. It is therefore considered that the upper limit of 3% merely represents conventional practice. Moreover, no evidence is found anywhere in the patent specification showing that stretching above the preferred upper limit of 3% is critical and should be avoided since so doing adversely affects specific properties of the alloy.

Hence the method set out in claim 1 of the third auxiliary request does not comprise technical features which require an inventive step with respect to the combined teaching of documents D11 and D2.

5. Fourth auxiliary request

In addition to the third auxiliary request, claim 1 of the fourth auxiliary comprises the steps of
(c) "preheating the ingot *for 5 to 15 hours at a temperature in the range of 400 to 470°C*" and

(g) "*air cooling* the solution heat treated product from the solution heat treatment temperature to below 150°C with a cooling rate of 0.2 °C/sec".

Although the patent specification discloses the temperature range and the time interval in step (c) as being preferred, it is noted that the preheating treatment known from D11 is carried out within the temperature range of 343 to 498°C for about 20 hour and for the same purpose. The patent specification fails to give any explanation as to why the preheating period should be limited to 5 to 15 hours. It is therefore concluded that the selected parameters in step (c) represent a mere embodiment of the process given in prior description of D11.

As to step (g) the respondent held the view that for the cooling speed "air cooling" implied an upper limit which was far below that achieved by "water quenching" used in D11. The Board cannot follow this argument. The respondent's position that cooling by (still or agitated) air is actually softer than by water quenching is not disputed. However, the cooling rate results not only from the cooling medium but depends, amongst others, also on the thickness of the sheet. Hence, the term "air cooling" does not define an upper limit for the cooling rate which could provide a clear distinction to water quenching. Again in this particular respect, the patent specification does not comprise any convincing evidence showing that "air cooling" is superior to "water quenching" as regards the performance of the hot and cold rolled final product.

The method set out in claim 1 of the fourth auxiliary request, therefore, does not involve an inventive step.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

V. Commare

T. Kriner