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Datasheet for the decision of 4 October 2024

Case Number: T 1440/22 - 3.2.03

Application Number: 14887198.1

Publication Number: 3124645

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Language of the proceedings: EN

Title of invention:
CASTING PRODUCT HAVING ALUMINA BARRIER LAYER

Patent Proprietor:
Kubota Corporation

Opponent:
Schmidt + Clemens + Co. KG

Headword:

Relevant legal provisions:
EPC Art. 123(2), 54
RPBA 2020 Art. 12(4), 13(1), 13(2)

Keyword:
Amendments - extension beyond the content of the application as filed (yes)
Novelty - implicit disclosure (yes)
Amendment to case - reasons for submitting amendment in appeal proceedings (yes)
Amendment after summons - exceptional circumstances (no)

Decisions cited:
T 0111/22, T 0450/20, T 1354/18

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 1440/22 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 4 October 2024

Appellant: (Patent Proprietor)	Kubota Corporation 2-47, Shikitsuhigashi 1-chome Naniwa-ku Osaka-shi, Osaka 556-8601 (JP)
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Respondent: (Opponent)	Schmidt + Clemens + Co. KG Kaiserau 2 51789 Lindlar (DE)
Representative:	König Szynka Tilmann von Renesse Patentanwälte Partnerschaft mbB Düsseldorf Mönchenwerther Straße 11 40545 Düsseldorf (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 31 March 2022 revoking European patent No. 3124645 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	C. Herberhold
Members:	B. Miller
	N. Obrovski

Summary of Facts and Submissions

I. European patent EP 3 124 645 B1 ("the patent") relates to a casting product having an alumina barrier layer.

II. An opposition against the patent was filed on the grounds of Article 100(b) and (c) EPC, and Article 100(a) EPC together with Articles 54 and 56 EPC.

The opposition division concluded that
- the main request and auxiliary requests 1 to 12 did not fulfil the requirements of Article 123(2) EPC,
- auxiliary request 13 did not fulfil the requirements of Article 84 EPC and
- auxiliary requests 14 to 16 did not fulfil the requirements of Article 54 EPC,

and decided to revoke the patent.

The decision was appealed by the patent proprietor ("the appellant").

III. The appellant requested at the end of the oral proceedings that the decision under appeal be set aside and that the patent be maintained on the basis of the main request or one of auxiliary requests 1 to 19, all submitted with the statement setting out the grounds of appeal.

The opponent ("the respondent") requested that the appeal be dismissed. Procedurally, the respondent further requested that auxiliary requests 17 to 19 not be admitted.

IV. Evidence

(a) The following documents, which were already cited during the opposition proceedings, are of particular importance to the present decision:

D1: US 2011/0318593 A1
D8: WO 2010/043375 A1

(b) The following further evidence was presented for the first time in appeal proceedings.

- In the statement setting out the grounds of appeal the appellant referred to further experimental evidence concerning sample 37 of D1 (in the following: "experiments-grounds"), the experiments on which this evidence was based being counter-experiments to those carried out by the respondent which the opposition division found convincing.

- With the letter of reply to the appeal the respondent filed:

D17: Investigation Report Z 552, 22 December 2022
D18: S. Wang et al.: "The effect of Si additions on the high temperature oxidation of a ternary Ni-10Cr-4Al alloy in 1 atm O_2 at 1100°C", Corrosion Science 51 (2009), pages 511-517
D19: H.-E. Zschau et al.: "Oxidation protection of Ni-base superalloys by halogen treatment", Materials and Corrosion 2011, 62, No. 7, pages 687-694
D20: J. Hall et al.: "The Initial Oxide Scale Development on a Model FeNiCrAl Alloy at 900°C in Dry and Humid Atmosphere: A

Detailed Investigation", Oxid Met (2014) 82, pages 225-247

- With a letter dated 15 February 2023 the appellant further submitted:

D21: annotated copy of the SEM images and line scans on pages 4-5 of D17

- With a letter dated 25 August 2023 the respondent resubmitted D20 as D22 and additionally filed:

D23: Investigation Report Z 585

V. Wording of the requests

(a) Main request

Claim 1:

A cast product having an alumina barrier layer including an aluminum oxide on a surface of a matrix, wherein the aluminum oxide has a solid solution formed by at least one of Cr, Ni, Si, and Fe in a relationship Al/(Cr+Ni+Si+Fe)≥2.0 in an atomic % ratio, and has a corundum structure that is 80 vol% or more of a crystal structure, and
wherein the matrix includes C in an amount of 0.05 to 0.7 mass%, Si in an amount of more than 0 mass% to 2.5 mass% or less, Mn in an amount of more than 0 mass% to 3.0 mass% or less, Cr in an amount of 15.0 to 50.0 mass%, Ni in an amount of 18.0 to 70.0 mass%, Al in an amount of 2.5 to 5.0 mass%, rare earth elements in an amount of 0.005 to 0.4 mass%, and W in an amount of 0.5 to 10.0 mass% and/or Mo in an amount of 0.1 to 5.0 mass%, and the balance includes Fe and inevitable

impurities, including at least one selected from the group consisting of Ti in an amount of 0.01 to 0.6 mass%, Zr in an amount of 0.01 to 0.6 mass%, and Nb in an amount of 0.1 to 1.8 mass%, and including B in an amount of 0 mass% to 0.1 mass%,
wherein the alumina barrier layer has a surface roughness (Ra) of 0.05 to 15 μm.

Claim 7:

A method for producing the cast product according to any one of claims 1 to 5,
wherein the method comprises a casting process, a surface treatment process and heat treatment process, the method being characterized in that
the surface treatment is performed to the surface on the alumina barrier layer of the cast product such that a surface roughness (Ra) of the alumina barrier layer is 0.05 to 15 μm,
and the heat treatment process comprises a two-stage heat treatment process,
wherein a first heat treatment is conducted at a temperature in the range of 600 to 900°C for 5 to 15 hours under an oxidizing atmosphere and aluminum oxide having a metastable γ or θ alumina structure is formed in the first heat treatment, and a second heat treatment is conducted at a temperature of at least 1050°C for 3 to 15 hours under an oxidizing atmosphere, the alumina oxide having a metastable γ or θ alumina structure formed by the first heat treatment is phase-transformed into an α alumina structure in the second heat treatment and the second heat treatment is conducted until oxygen passes through the aluminum oxide layer.

(b) Auxiliary requests 1 to 12

The method claim of auxiliary requests 1 to 12 is based on claim 7 of the main request.

The wording of the corresponding product claim 1 is not relevant to the present decision.

(c) Auxiliary request 13

Claim 1 corresponds to claim 1 of the main request.

(d) Auxiliary request 14

Claim 1 corresponds to claim 1 of the main request, except that the feature "wherein the alumina barrier layer has a surface roughness (Ra) of 0.05 to 15 µm" has been deleted.

(e) Auxiliary request 15

Claim 1 corresponds to claim 1 of auxiliary request 14, except that the claimed object has been changed from "A cast product" to "A centrifugal casting product".

(f) Auxiliary request 16

Claim 1 corresponds to claim 1 of auxiliary request 14, except that the claimed object has been changed from "A cast product" to "A reaction tube made of a centrifugal casting product".

(g) Auxiliary requests 17 to 19

Claim 1 of auxiliary requests 17 to 19 is based on claim 1 of auxiliary requests 14 to 16, except that, in

each case, the following feature has been added at the end:

"and wherein the aluminum oxide has an Al-rich layer in which the Al/(Cr+Ni+Si+Fe) on the matrix side is larger than that on the surface side."

VI. With the summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) RPBA indicating to the parties its preliminary, non-binding opinion that the appeal is likely to be dismissed.

VII. In reaction to the summons, the appellant presented further arguments in relation to D17 (appellant's letter of 21 November 2023).

VIII. Oral proceedings were held on 4 October 2024.

IX. The appellant's arguments can be summarised as follows.

(a) Main request - amendments

If the wording of claim 7 was interpreted in the required technically sensible manner the amendment in claim 7 did not extend beyond the teaching of paragraph [0045] of the application as originally filed (paragraph [0054] of the A2 publication).

A skilled person would not take the literal meaning of the feature "the second heat treatment is conducted until oxygen passes through the aluminum oxide layer" of the method according to claim 7. In particular, the term "until" would be interpreted by the skilled person as "at least to a stage [at which]".

The wording of claim 7 referred to a desired condition and not to a time limit. The method according to claim 7 thus required heating at least to a stage at which oxygen could pass through the aluminium oxide layer, which had been originally disclosed.

(b) Auxiliary requests 1 to 12 - amendments

Concerning the method claim of auxiliary requests 1 to 12, the same arguments applied as in the case of claim 7 of the main request.

(c) Auxiliary request 13 - novelty

D1 did not disclose a cast product having all the features of claim 1.

The experiments submitted by the respondent during the opposition proceedings ("Legierung 2200") were not strictly based on the disclosure of D1, since the product was not obtained by centrifugal die-casting as disclosed in D1.

The experimental evidence presented by the respondent did not constitute sufficient proof that the reproduction of the examples of D1 resulted in a cast product having all of the features as defined in claim 1.

Experimental evidence prepared by the appellant ("experiments-grounds") further demonstrated that the aluminium oxide layer of the cast product reproduced according to sample 37 of D1 did not fulfil the requirements of the relationship $Al/(Cr+Ni+Si+Fe) \geq 2.0$.

The reproduction of samples of D1 by the respondent thus did not show that, by following the teaching of D1, a product as claimed having two aluminium oxide layers, an Al-rich layer and an Al-poor layer was inevitably achieved.

The further experimental evidence D17 submitted by the respondent likewise did not demonstrate that, by reproducing sample 37 of D1, a cast product was obtained comprising an aluminium oxide across the whole thickness having "a solid solution formed by at least one of Cr, Ni, Si, and Fe in a relationship Al/(Cr+Ni+Si+Fe)≥2.0 in an atomic % ratio".

In addition, the respondent did not demonstrate that the reproduced sample obtained in D17 had an alumina barrier layer as defined by claim 1 over the entire surface of the product.

Moreover, it had not been demonstrated by the respondent that the alumina layer of the reproduced sample 37 of D1 obtained in D17 had the required corundum structure. This argument concerning the absence of proof of a corundum structure was not submitted for the first time during the oral proceedings before the Board but had already been raised in the statement setting out the grounds of appeal on page 8, penultimate paragraph.

(d) Auxiliary requests 14 to 16 - novelty

A regards novelty of claim 1 of auxiliary requests 14 to 16, the same arguments applied as in the case of claim 1 of auxiliary request 13.

(e) Auxiliary requests 17 to 19 - admittance

Due to the working restrictions during the COVID-19 pandemic, the appellant had not been in a position to prepare laboratory tests and hence to provide experimental counter-evidence during the opposition proceedings. The filing of auxiliary requests 17 to 19 was linked to the findings deriving from the experimental counter-evidence prepared in response to events during the opposition proceedings and the decision of the opposition division.

(f) Auxiliary requests 17 to 19 - novelty

Concerning novelty of claim 1 of auxiliary requests 17 to 19, the same arguments applied as in the case of claim 1 of auxiliary requests 14 to 16. Claim 1 of auxiliary requests 17 to 19 defined even more clearly the required presence of two aluminium oxide layers.

X. The respondent's counter-arguments to each of the above points can be summarised as follows.

(a) Main request - amendments

The amendments in claim 7 extended beyond the teaching of the application as originally filed.

The feature "the second heat treatment is conducted until oxygen passes through the aluminum oxide layer" of the method according to claim 7 defined the earliest moment when the second heat treatment can be stopped ("until oxygen passes through the aluminum oxide layer").

A corresponding teaching for a time limitation of the second heat treatment was not derivable from paragraph [0045] of the application as originally filed.

Moreover, paragraph [0045] of the application disclosed that oxygen passed through the aluminium oxide layer 22 as a result of the second heat treatment and that this aluminium oxide layer 22 formed the upper part of the alumina barrier layer, i.e. the diluted Al layer. In contrast to this teaching in paragraph [0045], it is specified in claim 7 that the heat treatment was conducted until oxygen passed through the aluminium oxide layer as a whole.

(b) Auxiliary requests 1 to 12 - amendments

Concerning the method claim of auxiliary requests 1 to 12, the same arguments applied as in the case of claim 7 of the main request.

(c) Auxiliary request 13 - novelty

D1 disclosed a cast product having implicitly all the features of claim 1 as demonstrated at least in the further experimental evidence D17.

The counter-experiments as submitted by the appellant in its statement setting out the grounds of appeal related to experiments not based on the disclosure of D1, since the surface roughness of the cast product produced by the appellant did not match the surface roughness disclosed in D1. The experiments of the appellant confirmed the disclosure of D1 that the surface roughness had an influence on the alumina

formation but did not give rise to any doubts on the experimental results obtained by the respondent.

The experimental report D17 confirmed beyond doubt that, by reproducing sample 37 of D1 (sample 3278-A), a cast product was obtained comprising an alumina barrier layer as defined by claim 1.

The objection of the appellant concerning the absence of proof of the presence of a corundum structure was raised for the first time at a late stage, namely during the oral proceedings before the Board and should not be admitted into the appeal proceedings. Moreover, it was not *prima facie* persuasive that the aluminium oxide layer obtained in D17 did not have the required corundum structure, since the formation of the corundum structure was only dependent on the second high-temperature heat treatment, as was also confirmed by the patent itself and D8. Moreover, it had already been demonstrated that, by reworking the examples of D1 by using a similar casting method ("Legierung 2200"), the alumina barrier layer obtained had a corundum structure.

Claim 1 did not require the relationship Al/(Cr+Ni+Si+Fe)≥2.0 to be fulfilled across the entire thickness of the layer or the cast product to comprise the alumina barrier layer over the whole surface area. In any case, the arguments of the appellant did not give rise to any doubt as to whether the barrier layer as a whole fulfilled the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0 and that the cast product reproduced according to sample 37 of D1 comprised the alumina barrier layer over the whole surface area.

(d) Auxiliary requests 14 to 16 - novelty

Concerning novelty of claim 1 of auxiliary requests 14 to 16, the same arguments applied as in the case of claim 1 of auxiliary request 13. In particular, the cast products disclosed in D1 were sample tubes made from centrifugally die-casting the molten alloys, see D1,[0061].

(e) Auxiliary requests 17 to 19 - admittance

The filing of auxiliary requests 17 to 19 was not linked to the alleged findings ("presence of two layers") derived from the experimental counter-evidence prepared by the appellant, since the wording of the respective claim 1 did not require the presence of two alumina layers. Hence, the events of the opposition proceedings and in particular the findings by the appellant derived from the experiments-grounds did not provide a justification for filing further claim requests during the appeal proceedings. These requests could and should have been submitted during the opposition proceedings.

(f) Auxiliary requests 17 to 19 - novelty

Concerning the novelty of claim 1 of auxiliary requests 17 to 19, the same arguments applied as in the case of claim 1 of auxiliary requests 14 to 16.

Reasons for the Decision

1. Main request - Article 123(2) EPC

1.1 Claim 7 is based on the manufacturing method disclosed in paragraphs [0037], [0038], [0041], [0043]-[0045] of the application as originally filed ("the application").

The opposition division concluded that the feature

"the second heat treatment is conducted until oxygen passes through the aluminum oxide layer"

in claim 7 extends beyond the teaching of the application - see point II.2 of the reasons.

The Board agrees with this conclusion.

1.2 The feature "the second heat treatment is conducted **until** oxygen passes through the aluminum oxide layer" (highlighting in bold added by the Board) of the method according to claim 7 defines the earliest moment when the second heat treatment can be stopped ("until oxygen passes through the aluminum oxide layer").

A corresponding teaching for a time limitation of the second heat treatment cannot be derived from the application.

Paragraph [0045] of the original application documents describes a property of the aluminium oxide layer which is obtained as a result of the second heat treatment:

"Then, the high-temperature heat treatment is further continuously performed on the cast product having the aluminum oxide layer in which the phase has been transformed to an α alumina structure (corundum structure), and **thus** oxygen passes through the aluminum oxide layer 22 as shown in FIG. 3."
(highlighting in bold by the Board)

Although this paragraph discloses that the second heat treatment results in an oxygen-permeable alumina layer 22, it does not disclose a time limitation or time relationship of the second heat treatment with respect to oxygen.

Likewise, the rest of the specification of the application does not provide support for a heat treatment being terminated as soon as oxygen starts to pass through the aluminium oxide layer.

1.3 The appellant argued, by reference to established case law (see Case Law of the Boards of Appeal, 10th edition, 2020, chapter II.A.6.1 and T 1354/18), that the wording of claim 7 had to be interpreted in a technically sensible manner and not read literally. The skilled person would interpret claim 7 as requiring the heating to be conducted "at least to a stage" at which oxygen can pass through the aluminium oxide layer. The wording of claim 7 therefore referred to a desired condition and not to a time limit.

This argument is not convincing.

1.4 The word "until" in the context of claim 7 ("the second heat treatment is conducted until oxygen passes through the aluminum oxide layer") defines an upper limit in time. This interpretation of the word "until" in

claim 7 corresponds to the conventional meaning of the word "until", which is not changed by the technical context of claim 7.

In contrast, the interpretation according to the appellant ("at least to a stage") defines a temporal lower limit. No support can be found in the application for the view that the word "until" in claim 1 should be interpreted contrary to its usual meaning, as proposed by the appellant. In particular, paragraph [0045] of the application does not provide a reason to interpret claim 7 contrary to its usual meaning (which is, in the present case, also its literal meaning), said paragraph [0045] does not use the wording of claim 7 and, therefore, cannot provide a reason to interpret the wording of claim 7 contrary to its wording.

1.5 Moreover, even if the interpretation of the appellant were accepted, the subject-matter of claim 7 would nevertheless extend beyond the teaching of the application.

The application discloses in paragraph [0045] that oxygen can pass through the aluminium oxide layer 22 as a result of the second heat treatment. This aluminium oxide layer 22 forms the upper part of the alumina barrier layer (see Figure 3 of the patent), i.e. the diluted Al layer.

In contrast to this teaching in paragraph [0045], claim 7 states that the heat treatment is conducted until oxygen can pass through the aluminium oxide layer as a whole.

1.6 In view of the above, the Board agrees with the conclusion of the opposition division in point II.2 of

the contested decision that the subject-matter of claim 7 of the main request extends beyond the teaching of the application as originally filed, contrary to Article 123(2) EPC.

2. Auxiliary requests 1 to 12 - Article 123(2) EPC

The method claim of auxiliary requests 1 to 12 contains the same feature as claim 7 of the main request that "the second heat treatment is conducted until oxygen passes through the aluminum oxide layer".

The subject-matter of the method claim of auxiliary requests 1 to 12 therefore extends beyond the teaching of the application for the same reasons as claim 7 of the main request.

3. Admittance of evidence filed in appeal proceedings

In the statement setting out the grounds of appeal the appellant referred to further experimental evidence concerning sample 37 of D1 ("experiments-grounds"), which is based on counter-experiments to those carried out by the respondent and which the opposition division found convincing ("Legierung 2200").

Each party, in reaction to issues raised by the other party in the appeal proceedings, submitted further evidence, i.e. the further experimental evidence D17, its annotated version D21 and documents D18 to D20, D22 and D23.

Both parties considered the submissions of the respective other party a legitimate reaction, and both parties agreed to the admittance of all of the aforementioned documents.

The Board shared this understanding and, in exercise of its discretion according to Articles 12(4) and 13(1) RPBA, admitted the "experiments-grounds" and D17 to D23 into the proceedings.

4. Auxiliary request 13 - novelty

4.1 D1 discloses a cast product with an alumina (Al_2O_3) barrier layer formed at a surface of the cast body. The barrier layer effectively prevents oxygen, carbon, nitrogen, etc. from penetrating inside the cast body - see paragraph [0019] of D1.

The examples of D1 describe a method of preparing sample tubes, wherein molten alloys are provided by atmospheric melting in a high-frequency induction melting furnace and wherein the tubes are obtained by centrifugal die-casting - see paragraph [0061] of D1.

The alloy of the tube of sample 37 has the following composition (mass %) - see table 1 of D1: 0.33% C, 0.3% Si, 0.2% Mn, 24.4% Cr, 45.3% Ni, 3.6% Al, 0.18% REM (rare earth metals), 2.8% W, 0.08% Ti and 0.2% Nb with the balance being Fe and inevitable impurities. The cast tube of sample 37 is machined over the surface to obtain a surface roughness of 0.14 Ra and is heat-treated at 1050°C. The thereby obtained Al_2O_3 layer has a thickness of 1.5 µm - see table 2 of D1.

4.2 D1 does not explicitly disclose the feature of claim 1 that the "aluminum oxide has a solid solution formed by at least one of Cr, Ni, Si, and Fe in a relationship $Al/(Cr+Ni+Si+Fe) \geq 2.0$ in an atomic % ratio, and has a

corundum structure that is 80 vol% or more of a crystal structure".

The opposition division concluded, on the basis of experimental evidence provided by the respondent during the opposition proceedings ("Legierung 2200"), that the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0 are fulfilled implicitly by sample 37 of D1. Moreover, for the "Legierung 2200", the respondent demonstrated during the opposition proceedings that the reproduced cast product obtained in the experiments has a corundum structure as required by claim 1 - see x-ray diffraction analysis on page 36 of the notice of opposition.

4.3 The appellant argues that the experiments presented by the respondent during the opposition proceedings are not strictly based on and limited to the disclosure in D1, since static casting had been used for the experiments instead of centrifugal die-casting as disclosed in D1. Moreover, the thickness of the Al_2O_3 layer obtained for the reproduced sample ("Legierung 2200") was greater (2.5 µm) than the thickness of the Al_2O_3 layer reported for sample 37 of D1 (1.5 µm).

In reaction to these objections raised by the appellant, the respondent filed further experimental evidence D17 with its letter of reply to the appeal. Sample 3278-A of D17 is manufactured according to sample 37 of D1 by centrifugal die-casting (see "Materials and Methods") - see paragraphs [109] to [127] of the letter of reply to the appeal. It it undisputed that the thickness of the Al_2O_3 layer of sample 3278-A corresponds essentially to the thickness of D1.

Hence, the objections of the appellant against the experimental evidence submitted by the respondent during the opposition proceedings ("Legierung 2200") are not pertinent in view of D17 and therefore do not need to be addressed in the following.

4.4 The appellant further argues that its own experimental evidence presented in the statement setting out the grounds of appeal ("experiments-grounds") demonstrates that the requirements of the relationship $Al/(Cr+Ni+Si+Fe) \geq 2.0$ are not fulfilled inherently when reworking sample 37 of D1.

This argument is not convincing.

For the experiments-grounds, tubes were cast according to D1. Before the heat treatment the specimen was machined over the surface. The surface roughness (Ra) of the specimen prepared by the appellant was measured to be 0.91 µm.

The surface roughness of the specimen used for the experiments of the appellant therefore does not correspond to the surface roughness of 0.14 µm for sample 37 of D1 - see Table 2.

D1 discloses in paragraph [0054] that the surface roughness of the cast body before the Al_2O_3 layer is formed thereon relates to the formation of Cr-oxide scale on the Al_2O_3 layer surface. Hence, the surface roughness has an influence on the formation and composition of the Al_2O_3 layer.

Therefore, the results obtained by the appellant in its experiments-grounds can be explained by the different surface roughness of the specimen used. This is

confirmed by sample 3278-B in D17 - see paragraphs [109] to [127] of the letter of reply to the appeal.

Moreover, sample 3278-Aof D17 does indeed demonstrates that the Al_2O_3 layer of the reproduced sample of the appellant fulfils the requirements of the relationship $Al/(Cr+Ni+Si+Fe) \geq 2.0$.

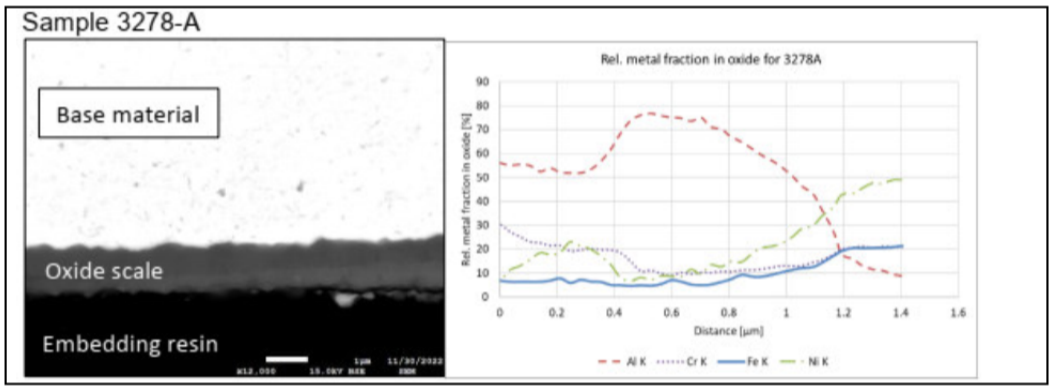
The "experiments-grounds" of the appellant therefore do not give rise to any doubt as to whether sample 37 of D1 falls within the scope of claim 1.

4.5 Concerning D17 the appellant argued, in its written submissions during the appeal proceedings, that the reproduction of sample 37 of D1 did not inevitably result in a product being achieved as claimed in the opposed patent having two oxide layers, an Al-rich layer and an Al-poor layer.

This argument is not convincing.

In the first place, claim 1 does not require the alumina layer to consist of an Al-rich layer and an Al-poor layer.

Moreover, D17 discloses, on page 4, a SEM image and line scans for sample 3278-A. In the plots of the concentration profiles, the x-axis reflects the distance, starting at the sample surface (oxide layer). The y-axis shows the relative fraction of metals within the oxide scale.



The different grey shadings of the oxide scale in the SEM image and the concentration of Al (dashed line on the top) from 0 to 0.4 µm and from 0.4 to 1 µm shown by the line scans demonstrate that sample 37 of D1 inherently comprises an aluminium oxide having an Al-rich portion on the matrix side and an Al-poor portion on the surface side.

4.6 In the letter dated 15 March 2023 the appellant further argued, by reference to D21, that the subject-matter of claim 1 differed from the reproduction of sample 37 of D1 according to D17 in that the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0 must be fulfilled over the entire thickness of the Al_2O_3 layer.

This argument is not convincing.

4.6.1 The patent discloses in paragraph [0050] that the aluminium oxide layer fulfils the relationship Al/(Cr+Ni+Si+Fe)≥2.0 after the low-temperature heat treatment. In addition, it is disclosed in paragraph [0057] that the Al-rich oxide layer also fulfils the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0 after the high-temperature heat treatment. However, this disclosure of the description is not reflected by claim 1. Moreover, claim 1 does not state that the alumina barrier comprises two aluminium

oxide layers which both fulfil the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0.

According to the established principle of the primacy of the claims (see T 111/22, Reasons 1.9, with further references), limitations which are not present in the claim but which can only be derived from the description are not to be taken into account. The description and the drawings can only be used for interpreting features which are already present in the claims, but not for adding further claim features or for replacing existing claim features by others (see T 450/20, Reasons 2.15).

Claim 1 requires an alumina barrier layer "including an aluminum oxide on a surface of a matrix, wherein the aluminum oxide has a solid solution formed by at least one of Cr, Ni, Si, and Fe in a relationship Al/(Cr+Ni+Si+Fe)≥2.0 in an atomic % ratio".

However, the wording of claim 1 ("including", "has") does not specify that the alumina barrier layer consists of aluminium oxide which fulfils the requirements of the relationship Al/(Cr+Ni+Si+Fe)≥2.0 at any point of depth, i.e. across the entire thickness. The definition of claim 1 is satisfied if the entire alumina barrier layer fulfils the requirements of the relationship as defined in claim 1. This is clearly the case for sample 37 of D1 as demonstrated in D17, since the relationship Al/(Cr+Ni+Si+Fe) for sample 3278-A is 5.49 - see D17, page 6, last table.

Hence, the wording of claim 1 concerning the relationship Al/(Cr+Ni+Si+Fe) does not allow a

distinction to be made between the claimed subject-matter and sample 37 of D1.

4.6.2 In addition, the arguments presented by the respondent in relation to D22 (Figure 19) and D23 (EDX measurement for samples 2187-C and 2187-D, which correspond to example 6 of the patent) render it questionable whether

- the skilled person would interpret claim 1 in line with the arguments of the appellant and

- the examples of the patent fulfil the conditions of claim 1 in the more narrow interpretation proposed by the appellant.

Regarding the examples of the patent as summarised in Table 3, the Board observes that even the results of the EDX analysis of the various examples listed in Table 3 of the patent only present an average value for all elements identified therein over the entire thickness. The examples of the patent therefore do not demonstrate that the Al oxide layer fulfils the requirements of the relationship $Al/(Cr+Ni+Si+Fe) \geq 2.0$ across the entire thickness and therefore also do not support the interpretation of the appellant.

4.7 The appellant further argues that the alumina barrier layer could be present only on part of the surface of the reproduced product of D1 according to D17.

This argument of the appellant is based on mere speculation and therefore does not convince the Board. The appellant did not provide any substantiated reason as to why the manufacturing method of the examples of D1 - which is very similar to the manufacturing method described in the patent - would not lead to the

formation of the barrier layer over the entire surface or why this allegedly would not have been achieved by the reproduction according to D17.

4.8 During the oral proceedings before the Board the appellant argued for the first time that D17 did not demonstrate that the reproduced sample 37 of D1 has an aluminium oxide layer with corundum structure as required by claim 1.

The Board did not admit this late-filed argument, for the following reasons.

4.8.1 D17 was filed by the respondent already with the letter of reply to appeal. The appellant reacted to the filing of D17 in two further submissions (letters dated 15 March 2023 and 21 November 2023). With the letter dated 15 March 2023 the appellant even submitted annotated pages of D17 as D21.

However, the appellant did not present in either of these further submissions the argument that the aluminium oxide of the reproduced sample 37 of D1 as described in D17 did not have a corundum structure.

This argument is also not derivable from the penultimate paragraph on page 8 of the statement setting out the grounds of appeal. This paragraph cannot be understood to address D17 due to the simple fact that D17 was only submitted later.

It is also not apparent that the appellant even implicitly raised doubts concerning the corundum structure on page 8 of the statement setting out the grounds of appeal by quoting the whole definition of claim 1 relating to the aluminium oxide layer ("the

aluminum oxide has a solid solution formed by at least one of Cr, Ni, Si, and Fe in a relationship Al/(Cr+Ni+Si+Fe)≥2.0 in an atomic % ratio, and has a corundum structure that is 80 vol% or more of a crystal structure").

The reasoning in the contested decision is based on the experimental evidence filed by the respondent during the opposition proceedings ("Legierung 2200"). For those experiments the corundum structure of the aluminium oxide had been demonstrated - see x-ray diffraction analysis on page 36 of the notice of opposition. The appellant did not substantiate in the statement setting out the grounds of appeal why, in its view, the aluminium oxide of the cast product made of "Legierung 2200" had no corundum structure, contrary to the experimental evidence presented in the notice of opposition. Hence, merely quoting the whole definition of claim 1 relating to the aluminium oxide layer without a further substantiation of all of the various aspects encompassed therein cannot be regarded as an argument that each feature was individually contested.

It follows that the objection against D17 raised during the oral proceedings before the Board amounts to an amendment to the case within the meaning of Article 13(2) RPBA.

Accordingly, the admittance of the late-filed amendment to the case is at the discretion of the Board.

4.8.2 In exercising its discretion under Article 13(2) RPBA, the Board took into consideration that

- the appellant has not presented any exceptional

circumstances for justifying the late amendment to its case

- the respondent was not in a position, during the oral proceedings before the Board, to react to the new objections against the experimental evidence already presented by the respondent with its letter of reply to the appeal.

- the argument is *prima facie* not persuasive, since the patent (see paragraphs [0052] and [0053]) and also D8 (see page 5, lines 31 to 34) confirm that the second heat treatment is decisive for forming the corundum structure (α-aluminium oxide), which has been applied also during the reproduction of sample 37 of D1 according to D17 (see page 2: 1050 °C for 10 h).

The Board therefore did not admit the new objection of the appellant against D17 under Article 13(2) RPBA.

4.9 In view of the above, the Board concluded that the subject-matter of claim 1 of auxiliary request 13 lacks novelty, and does not therefore comply with the requirements of Article 54 EPC.

5. Auxiliary requests 14 to 16 - novelty

The product obtained by D1 is a centrifugal die-cast sample tube (146 mm in outside diameter, 22 mm in wall thickness and 270 mm in length) - see paragraph [0061] of D1.

Hence, in line with the submissions by both parties regarding novelty, the arguments presented above with

regard to claim 1 of auxiliary request 13 equally apply to claim 1 of each of auxiliary requests 14 to 16.

The subject-matter of claim 1 of auxiliary requests 14 to 16 therefore lacks novelty, contrary to Article 54 EPC.

6. Auxiliary requests 17 to 19 - admittance

6.1 Auxiliary requests 17 to 19 were filed for the first time together with the statement setting out the grounds of appeal.

Under Article 12(4) RPBA their admittance is at the discretion of the Board.

6.2 In exercising its discretion, the Board took into account that the filing of the further auxiliary requests was a reaction to the events in the opposition proceedings:
During the opposition proceedings, experimental evidence relating to D1's implicit disclosure was presented by the respondent. The appellant stated that, due to the working restrictions during the COVID-19 pandemic, it had not been in a position to prepare laboratory tests and hence to provide experimental counter-evidence during the opposition proceedings. According to the appellant, the findings (presence of two aluminium oxide layers) derived from the experimental counter-evidence presented in appeal ("experiments-grounds") motivated it to file auxiliary requests 17 to 19.

6.3 In view of the above and in order to clarify the questions of

- whether this wording correctly reflects the appellant's findings with regard to its own test results in the reworking of D1 ("experiments-grounds")
- whether the chosen wording of the features inserted into claim 1 of auxiliary requests 17 to 19 distinguishes the claimed subject-matter from D1 and
- whether the requests can ultimately be considered allowable after detailed consideration of the available evidence

the Board considered it appropriate to admit the requests into the proceedings.

7. Auxiliary requests 17 to 19 - novelty

7.1 Claim 1 of auxiliary requests 17 to 19 is based on claim 1 of auxiliary requests 14 to 16, exempt that, in each case, the following feature has been added at the end:

"and wherein the aluminum oxide has an Al-rich layer in which the Al/(Cr+Ni+Si+Fe) on the matrix side is larger than that on the surface side."

The feature added to claim 1 of auxiliary requests 17 to 19 requires the presence of an aluminium oxide which comprises an Al-rich layer with varying aluminium content, the Al content being larger on the matrix side than on the surface side, but does not require the barrier layer to comprise two aluminium oxide layers.

7.2 D17 discloses on, page 4, in the line scans for sample 3278-A that a cast tube reproduced according to sample 37 of D1 comprises an aluminium-rich layer

wherein the relationship Al/(Cr+Ni+Si+Fe) on the matrix side is larger than that on the surface side due to the higher Al-concentration on the matrix side (the matrix side is on the right-hand side of the line scan) - see point 4.5 above.

7.3 The Board therefore concluded that the subject-matter of claim 1 of auxiliary requests 17 to 19 lacks novelty over D1.

8. In view of the above, none of the requests on file is allowable. The appeal of the patent proprietor is therefore not successful.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Spira C. Herberhold

Decision electronically authenticated