

**Internal distribution code:**

- (A) [ - ] Publication in OJ
- (B) [ - ] To Chairmen and Members
- (C) [ - ] To Chairmen
- (D) [ X ] No distribution

**Datasheet for the decision  
of 10 January 2025**

**Case Number:** T 0621/23 - 3.2.03

**Application Number:** 14712085.1

**Publication Number:** 2962057

**IPC:** F28F19/02, F28F21/08, C09D5/08,  
C09D7/61, C23C22/34, C23C22/36

**Language of the proceedings:** EN

**Title of invention:**  
ALUMINUM HEAT EXCHANGER WITH CORROSION RESISTANT COATING

**Patent Proprietor:**  
Carrier Corporation

**Opponent:**  
Helbig, Christian, Dr.

**Headword:**

**Relevant legal provisions:**  
EPC Art. 123(2), 54(3), 54(2), 87(1), 56

**Keyword:**

Amendments - extension beyond the content of the application  
as filed (yes)

Novelty - prior European application - (yes)

Priority - first application - (yes)

Inventive step - non-obvious alternative

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

Boards of Appeal of the  
European Patent Office  
Richard-Reitzner-Allee 8  
85540 Haar  
GERMANY  
Tel. +49 (0)89 2399-0

Case Number: T 0621/23 - 3.2.03

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.03**  
**of 10 January 2025**

**Appellant:** Helbig, Christian, Dr.  
(Opponent) Chemin de la Croisette 42  
1260 Nyon (CH)

**Representative:** Hoefler & Partner Patentanwälte mbB  
Pilgersheimer Straße 20  
81543 München (DE)

**Respondent:** Carrier Corporation  
(Patent Proprietor) One Carrier Place  
Farmington, CT 06034 (US)

**Representative:** Dehns  
10 Old Bailey  
London EC4M 7NG (GB)

**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 17 January 2023  
rejecting the opposition filed against European  
patent No. 2962057 pursuant to Article 101(2)  
EPC.**

**Composition of the Board:**

**Chairman** C. Herberhold  
**Members:** B. Miller  
J. Hoppe

## **Summary of Facts and Submissions**

I. European patent No. 2 962 057 B1 ("the patent") relates to aluminium heat exchangers that are resistant to corrosion.

II. An opposition against the patent was filed on the grounds of Article 100(c) EPC and Article 100(a) EPC in conjunction with Articles 54 and 56 EPC. The opposition division decided to reject the opposition.

This decision was appealed by the opponent ("the appellant").

III. Cited evidence

(a) The following documents that were cited during the opposition proceedings are of particular importance for the present decision:

D1: EP 0 937 757 A1  
D3: JP 2005 257257 A  
D3a WO 2005/078372 A1  
D5: US 6,521,029 B1  
D6: WO 2012/018536 A2  
D9: WO 2013/138218 A1  
D9\*: US 61/611,214 (priority document of D9)

(b) The patent proprietor ("the respondent") filed the following with its submission dated 7 January 2025:

- D15: "Top", Merriam-Webster Dictionary, <https://www.merriam-webster.com/dictionary/top>.  
Last accessed 6 January 2025
- D16: "Top", Cambridge Dictionary, <https://dictionary.cambridge.org/dictionary/english/top>.  
Last accessed 6 January 2025
- D17: "Top", The Shorter Oxford English Dictionary of Historical Principles, vol. II, 3rd edn., 1990, page 2326
- D18a: ISO 4618:2023
- D18b: ISO 4618:2014

IV. Wording of the requests underlying this decision

(a) Main request (claims as granted)

Claim 1 reads as follows (with feature numbering added in "[ ]" and amendments with respect to claim 1 as originally filed marked in bold):

- [1.1] "A heat transfer system
- [1.2] comprising a heat transfer fluid circulation loop, comprising a heat exchanger disposed in said heat transfer fluid circulation loop,
- [1.3] the heat exchanger comprising an aluminum alloy exterior surface having thereon a top surface coat on at least a portion of the heat exchanger
- [1.3.1] **of a mixed-metal oxide layer integrated with the aluminum alloy,**

[1.3.2] derived from a composition comprising a trivalent chromium salt and an alkali metal hexafluorozirconate."

Claim 13 reads as follows (with feature numbering added in "[ ]" and amendments with respect to claim 1 as originally filed marked in bold):

[13.1] "A method of producing **a the** heat transfer system **of any of claims 1-12**, comprising:  
[13.2] contacting an aluminum alloy exterior surface of a heat exchanger with a composition  
[13.3] comprising a trivalent chromium salt and an alkali metal hexafluorozirconate to form a top surface coat on the aluminum alloy surface  
[13.3.1] **of a mixed-metal oxide layer integrated with the aluminum alloy,**  
[13.4] and assembling the heat exchanger comprising said top surface coat into a heat transfer fluid circulation loop."

(b) Auxiliary request 1

Claims 1 and 13 correspond to claims 1 and 13 of the main request except that in features 1.3.1 and 13.3.1 the term "permanently" has been incorporated as follows:

"of a mixed-metal oxide layer **permanently** integrated with the aluminum alloy,"

(c) Auxiliary request 2

Claims 1 and 13 correspond to claims 1 and 13 of the main request except that the following feature has been added at the end:

"wherein the mixed-metal oxide layer has a thickness of 50 - 100 nm"

(d) The wording of the remaining auxiliary requests is not relevant for this decision.

V. With its summons to oral proceedings, the Board sent a communication pursuant to Article 15(1) RPBA setting out its preliminary, non-binding opinion on the case. In particular, the board questioned whether the expression "top surface coat" was sufficient to disclaim further coatings.

VI. Oral proceedings were held on 10 January 2025 by videoconference.

VII. At the end of the oral proceedings, the following requests were maintained by the parties.

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed (main request), or, as an auxiliary measure, that the patent be maintained in amended form on the basis of one of auxiliary requests 1 to 39 as submitted with the reply to the statement of grounds of appeal.

VIII. The appellant's arguments, as far as they are relevant for this decision, can be summarised as follows.

(a) Admittance of documents D15 to D18

The respondent's submissions with its letter of 7 January 2025 (documents D15 to D18) were only filed shortly before the oral proceedings before the board. They were therefore late filed and should not be admitted into the appeal proceedings.

(b) Main request - amendments

The subject-matter of claim 1 as granted extended beyond that of the application as filed because claims 1 and 13 did not encompass the thickness range of the mixed-metal oxide layer or the "permanent" nature of its integration with the aluminium alloy. Moreover, claim 13 did not define all of process steps (a) to (d) (with regard to the labelling of the steps, see point 13.2 of the impugned decision) in conjunction with the mixed-metal oxide layer as disclosed in paragraph [0028] of the application as filed.

(c) Auxiliary request 1 - amendments

Concerning the missing definition of the thickness of the mixed-metal oxide layer, the same arguments applied as those set out with respect to the main request.

(d) Auxiliary request 2 - novelty in view of D1

D1 disclosed a heat exchanger comprising a hydrophilic film having a "reticular" structure formed of a water-soluble polymer and a water-soluble trivalent chromium

compound. A "reticular" structure was no different from a mixed-metal oxide layer integrated with the aluminium alloy. This interpretation was supported by the fact that the patent also disclosed the possibility that the coating composition comprised polymeric thickeners. The thickness defined in claim 1 was implicitly achieved by the coating process according to D1, or could at least be obtained following the teaching of that document.

(e) Auxiliary request 2 - novelty in view of D6

D6 disclosed a heat transfer system comprising a heat exchanger. The heat exchanger comprised an aluminium alloy exterior surface which comprised a trivalent chrome conversion coating.

It was well known in the art that a trivalent chrome conversion coating comprised a trivalent chromium salt in combination with an alkali metal hexafluorozirconate, as also confirmed by the patent in paragraphs [0004] and [0017]. The thickness as defined in claim 1 was implicitly achieved by the coating process according to D6, or could at least be obtained following the disclosure of that document.

(f) Auxiliary request 2 - novelty in view of D9

D9 was relevant for the purpose of assessing the novelty of the patent under Article 54(3) EPC.

D9 disclosed a heat exchanger comprising an aluminium alloy exterior surface having thereon a mixed-metal oxide layer integrated with the aluminium alloy derived from a composition comprising a trivalent chromium salt and an alkali metal hexafluorozirconate (SurTec 650).

D9 described that the conversion-coated heat exchanger substrate was evaluated by visual inspection. At least at that point during the manufacture of the heat exchanger, it had a top surface coat as defined by claim 1.

Moreover, a further coating was only optional according to D9 ([0012]: "in one exemplary embodiment"). In embodiments without a further optional corrosion-inhibitive electrocoating, the conversion coating constituted the top coat as defined in claim 1.

(g) Validity of the priority claim

D9 belonged to the same applicant as the priority document of the patent. D9 and its priority document D9\* already disclosed the invention as defined in claim 1. D9\* was therefore the first application directed to the invention of the patent. Therefore, the priority document of the patent was not the first application within the meaning of Article 87(1) EPC and consequently the priority was not validly claimed.

(h) Auxiliary request 2 - inventive step starting from D6

D6 disclosed a heat exchanger comprising a trivalent chromium conversion layer. D6 did not state that it was essential to apply a further coating. Therefore, D6 disclosed the possibility of using a trivalent chromium conversion layer as a top coat.

Starting from D6, it was obvious to the skilled person to select a commonly used coating composition such as that disclosed in D5 in order to provide a top coat as defined by claim 1. As a consequence, the skilled person could select any thickness for the top coat without needing any inventive skill.

(i) Auxiliary request 2 - inventive step starting from D1

Starting from D1, it was obvious to the skilled person to modify the coating of D1 by leaving out the polymer, since they would always try to reduce the thickness of a coating in a heat exchanger to reduce its thermal resistance. Moreover, it was well known, as demonstrated by D5, that a trivalent chromium conversion layer provided the required corrosion resistance. Hence, it was obvious to replace the polymeric coating according to D1 with a trivalent chromium conversion layer as disclosed in D5.

(j) Auxiliary request 2 - inventive step starting from D3a

Starting from D3a, it was obvious to the skilled person to modify the coating of D3 by using a well-known trivalent chromium conversion layer such as that disclosed in D5.

IX. The respondent's counter-arguments can be summarised as follows.

(a) Admittance of documents D15 to D18

In its communication under Article 15(1) RPBA, the Board for the first time questioned the interpretation of the term "top surface coat" that had been adopted in the reasoning of the contested decision and in the submissions of the appellant. Therefore, exceptional circumstances existed for filing further submissions (documents D15 to D18) with the letter of

7 January 2025. These submissions should be admitted into the appeal proceedings.

(b) Main request - amendments

Paragraph [0028] of the application as filed in combination with Figure 4 made it clear to a skilled person that the formation of a mixed-metal oxide layer was relevant, but not the thickness thereof. Moreover, the thickness of the mixed-metal oxide layer was not essential for obtaining the desired corrosion resistance.

The "permanent" nature of the mixed-metal oxide layer was implicitly defined by claim 1 due to the required integration with the aluminium alloy.

Moreover, paragraph [0028] of the application as filed disclosed the allegedly omitted individual process steps using facultative wording only. Hence, their omission in the wording of claim 13 did not result in an unallowable generalisation.

(c) Auxiliary request 1 - amendments

Concerning the missing definition of the thickness of the mixed-metal oxide layer, the same arguments applied as those set out with respect to the main request.

(d) Auxiliary request 2 - novelty in view of D1

D1 disclosed a heat exchanger comprising a polymeric coating having a reticular structure comprising a trivalent chromium salt. The hydrophilic polymeric film of D1 was not equivalent to a mixed-metal oxide layer integrated with the aluminium alloy as required by

feature 1.3.1 of claim 1. Moreover, the coating obtained by D1 did not have a thickness of 50 to 100 nm as required by claim 1.

(e) Auxiliary request 2 - novelty in view of D6

D6 disclosed only in general terms that a heat exchanger could comprise a coating, such as trivalent chromium conversion coats and zirconium conversion coats, for enhancing corrosion resistance. D6 did not disclose the thickness of the conversion coats, the presence of an alkali metal hexafluorozirconate in the coating composition or a coating of a mixed-metal oxide layer. Moreover, D6 did not specify whether or not the conversion layer was further coated.

(f) Auxiliary request 2 - novelty in view of D9

D9 disclosed a heat transfer system in which the heat exchanger was coated with a multiple layer coating, wherein the chromium conversion layer was not the top coat.

Claim 1 of auxiliary request 2, however, defined that the heat exchanger comprised a single layer coating, since the conversion coating was not only defined as being the top coat, i.e. the outermost final layer, but it was also defined as being integrated with the aluminium alloy. Hence, the embodiments of D9 were not relevant for claim 1 because they all described a conversion layer in combination with further coats such as a corrosion-inhibitive electrocoating 16 and a corrosion-inhibitive top coat 18. This also applied to the general part of the disclosure in paragraph [0012].

Moreover, claim 1 was directed to a heat transfer system comprising a heat transfer fluid circulation loop with a heat exchanger disposed in said heat transfer fluid circulation loop and not a heat exchanger per se. Claim 1 therefore did not encompass an isolated heat exchanger as such in an intermediate production state.

(g) Validity of the priority claim

The subject-matter of auxiliary request 2 was novel over the disclosure of D9. Therefore, the priority document of the patent was the first application within the meaning of Article 87(1) EPC and thus the priority was validly claimed.

(h) Auxiliary request 2 - inventive step starting from D6

D6 disclosed in a general manner the possibility of providing a heat exchanger comprising a chromium (III) conversion layer.

Neither D6 nor the common general knowledge such as that represented in D5 provided any indication that a single trivalent chromium conversion layer as defined in claim 1 not only has the desired negligible thermal resistance but also provided sufficient corrosion resistance for a heat exchanger.

(i) Auxiliary request 2 - inventive step starting from D1

D1 disclosed a coating in the form of a hydrophilic polymer film comprising a salt of chromium (III).

Therefore, D1 was not a realistic starting point for the assessment of inventive step, since D1 related to a different coating system (hydrophilic polymeric film) from the coating system described in the patent (trivalent chromium conversion layer).

Moreover, even if the skilled person had started from D1, neither D1 nor the common general knowledge such as that represented in D5 would have provided any indication that a single trivalent chromium conversion layer provided sufficient corrosion resistance for a heat exchanger.

(j) Auxiliary request 2 - inventive step starting from D3a

D3a disclosed a heat transfer system comprising an aluminium alloy conversion coating obtained by applying chromium acid chromate or phosphoric acid chromate solutions.

Therefore, D3a was not a realistic starting point for the assessment of inventive step because D3a related to a different coating system (hexavalent chromium) from the coating system described in the patent (trivalent chromium conversion layer).

Moreover, even if the skilled person had started from D3a, neither D3a nor the common general knowledge such as that represented in D5 would have provided any indication that a single trivalent chromium conversion layer as defined in claim 1 provided sufficient corrosion resistance for a heat exchanger.

## **Reasons for the Decision**

1. Main request - amendments (Article 100(c) EPC)

1.1 Alleged basis for the amendments

Claims 1 and 13 as filed have been amended by the addition of the feature that the top surface coat is formed

"of a mixed-metal oxide layer integrated with the aluminum alloy".

The amendment is based on paragraph [0028] of the application as originally filed (in line with the submissions by the parties; in the following, reference is made to the application as published: WO 2014/134479 A2, "the application").

Paragraph [0028] of the application describes how a mixed-metal oxide layer can be obtained by a process of contacting the aluminium surface with a treatment composition, i.e. by an in-situ conversion coating process.

However, throughout the application, in particular in the general parts thereof, the coating is only defined in terms of its precursor materials: "top surface coat derived from a composition comprising a trivalent chromium salt and an alkali metal hexafluorozirconate", without any reference to a mixed-metal oxide layer integrated with the aluminium alloy as required by claims 1 and 13.

Hence, the following sentence of paragraph [0028] of the application is the only part of the original disclosure linking the precursor materials to the mixed-metal oxide layer produced:

"The resulting coating as applied by the methods described above produces a mixed-metal oxide layer of approximately 50 - 100 nm in thickness permanently integrated with the aluminum alloy."

1.2 Unallowable omission of the thickness range in claims 1 and 13

1.2.1 In line with the finding of the opposition division in point II.15.2 of the contested decision, the respondent argued that there was "not a recognisable functional or structural relationship" between feature 1.3.1 (surface coat of a mixed-metal oxide layer integrated with the aluminium alloy) and the thickness range of 50 - 100 nm.

This is not persuasive.

1.2.2 The structural and functional relationship is explicitly defined in the wording of paragraph [0028], where it is stated that "the resulting coating **as applied by the methods described above produces** a mixed-metal oxide layer of approximately 50 to 100 nm" (emphasis added by the Board). This statement refers back to the conversion coating methods described earlier, regardless of which parameters are selected from the "wide range of possibilities for the method steps".

Hence, the application leaves no doubt that the manufacturing methods described therein necessarily

resulted in a conversion layer which was not only a "mixed-metal oxide layer" but a "mixed-metal oxide layer of approximately 50 to 100 nm".

It follows that the application teaches a functional relationship between the use of the various coating methods and the formation of a mixed-metal oxide layer having a thickness of approximately 50 to 100 nm. The application does not contain a direct and unambiguous disclosure that a mixed-metal oxide layer having any arbitrary thickness can be obtained by the methods described therein.

Moreover, the last sentence of paragraph [0028] of the application does not provide such a disclosure either, since this sentence refers back to "the" coated aluminium surface described earlier, and simply states that the previously described subject is schematically depicted in Figure 4.

- 1.2.3 Whether or not the claimed range is "**essential** for obtaining the desired corrosion resistance" is not relevant for the question of added matter. Instead, what is necessary is that the subject-matter of amended claims 1 and 13 is directly and unambiguously derivable from the application as filed using common general knowledge; cf. the "gold standard", Case Law of the Boards of Appeal, 10th edition, 2022, II.E.1.3.1.

Yet this is not the case, since the application does not disclose a mixed-metal oxide layer in more general terms; nor does it contain a statement according to which the thickness of the mixed-metal oxide layer can be freely selected from a wider range than that explicitly disclosed in paragraph [0028].

1.2.4 Therefore, the omission of the thickness range in the wording of claims 1 and 13 constitutes an unallowable intermediate generalisation of the teaching of the application.

1.3 Alleged unallowable omission of process steps in claim 13

1.3.1 According to point II.13.2 of the contested decision, the following process steps can be identified in paragraph [0028] of the application:

- a) "The treatment composition can be applied by any of a number of known coating techniques including dip coating, spray coating, brush coating, roll coating etc."
- b) "The post treatment of the metal coating can be carried out at temperatures ranging from ambient temperatures up to about 65°C."
- c) "The duration for which the composition is contacted with the aluminum alloy before subsequent processing such as rinsing and/or drying can range widely. Exemplary contact times can range from 5 to 15 minutes."
- d) "The coating may be air dried at ambient air conditions, or can be subjected to accelerate drying by any of the methods known in the art[...] Exemplary drying conditions include about 24 hours at room temperature and less than 50% relative humidity, or about 2 hours at 50."
- e) "The resulting coating as applied by the methods described above produced a mixed-metal oxide layer of approximately 50-100 nm in thickness permanently integrated with the aluminium alloy."

- 1.3.2 The Board agrees with the opposition division that the subject-matter of claim 13 does not extend beyond the teaching of the application because process steps a) to d) are not explicitly mentioned.

Claim 13 already defines both the precursor materials (the "treatment composition"), the final product (the "mixed metal oxide layer") and also the in situ conversion coating treatment ("contacting the surface [...] with a composition").

Therefore, step (a) is already defined in claim 13.

The further curing conditions defined in paragraph [0028] of the application are all disclosed as being optional (for a coating in accordance with step a) by the use of facultative wording such as "can", "may", "exemplary". This includes parameters such as contact time, temperature of the post treatment and drying time (indicated as steps "b)" to "d)" above).

- 1.4 Alleged unallowable omission of the term "permanently"

Claim 1 of the main request defines that the top surface coat is "integrated with the aluminum alloy". The claim wording therefore leaves no doubt that the top surface coat is permanently fixed on the aluminium surface. The omission of the thus redundant term "permanent" as disclosed in paragraph [0028] of the application does not result in the subject-matter extending beyond the teaching of the application.

- 1.5 In summary, the ground of opposition pursuant to Article 100c) EPC prejudices the maintenance of the patent according to the main request for the reasons set out in point 1.2. above.

2. Auxiliary request 1 - amendments

Claims 1 and 13 of auxiliary request 1 do not define the thickness of the mixed-metal oxide layer.

Therefore, the same argument as those set out with respect to claims 1 and 13 of the main request applies (see point 1.2 above).

It follows that the amendments to claims 1 and 13 do not fulfil the requirement of Article 123(2) EPC.

3. Auxiliary request 2 - amendments

The appellant's objections against the original disclosure of claims 1 and 13 of auxiliary request 2 on the same basis as that discussed in points 1.3.2 and 1.4 are not convincing for the reasons already discussed. The objections discussed in point 1.2 above have been overcome by the amendment, i.e. the specification of the thickness of the mixed-metal oxide layer in accordance with paragraph [0028] of the application.

4. Auxiliary request 2 - novelty

4.1 Claim interpretation

4.1.1 Claim 1 relates to a heat transfer system comprising a heat transfer fluid circulation loop and a heat exchanger disposed in said heat transfer fluid circulation loop.

Hence, claim 1 does not define an isolated heat exchanger at an arbitrary stage of its manufacturing process but is instead directed to an assembled heat

transfer system comprising the heat exchanger and a heat transfer fluid circulation loop.

- 4.1.2 Moreover, the heat exchanger according to claim 1 comprises a top surface coat of a mixed-metal oxide layer integrated with the aluminium alloy on its exterior surface.
- 4.1.3 In points 8.1.2 and 8.1.3 of its communication under Article 15(1) RPBA, the Board for the first time questioned the interpretation of the term "top surface coat" in the context of the discussion of novelty over D9. The interpretation proposed by the Board was in contradiction to both the interpretation adopted by the opposition division (see point II.22.2 of the reasons of the contested decision) and the interpretation presented by the appellant (see point 7.1 of the statement setting out the grounds of appeal, in particular page 7, sixth paragraph).

The respondent was thus confronted with a new interpretation when it received the communication from the Board.

This qualifies as exceptional circumstances for filing further arguments supported by further evidence (documents D15 to D18) relevant for the interpretation of the feature "top surface coat" with the letter of 7 January 2025.

Exercising its discretion under Article 13(2) RPBA, the Board thus decided to admit into the proceedings the new submissions in the respondent's letter of 7 January 2025 as well as documents D15 to D18 enclosed therewith.

4.1.4 As evidenced by D18a and D18b (ISO norms 4618 from the neighbouring field of coatings of paints and varnishes), in the field of coatings a "top coat" is defined as the final coat of a coating system. Therefore, the respective feature in claim 1 shall be interpreted accordingly.

Hence, claim 1 requires that the mixed-metal oxide layer is the final layer on the surface of the heat exchanger of the heat transfer system, i.e. there is no further coating on top of the mixed-metal oxide layer.

At the same time, the mixed-metal oxide layer is defined as being integrated with the aluminium alloy. Hence, no further coating is present between the aluminium alloy and the mixed-metal oxide layer.

It follows that claim 1 addresses a system comprising a heat exchanger having a single mixed-metal oxide layer on the surface of the aluminium alloy.

4.2 Novelty over D1

4.2.1 The subject-matter of claim 1 is novel over D1.

Paragraph [0070] of D1 discloses that the water-soluble polymer and the water-soluble chromium (III) compound form a film having a reticular structure formed by the water-soluble polymer comprising the trivalent chromium compound. Claim 9 and Table 1 of D1 further confirm that the composition disclosed in D1 results in a hydrophilic film being formed on the surface of the aluminium alloy, comprising water-soluble salts of chromium (III) such as chromium biphosphate, chromium fluoride or chromium sulfate. It follows that the hydrophilic polymeric film of D1 is not equivalent to a

mixed-metal oxide layer integrated with the aluminium alloy as required by feature 1.3.1 of claim 1.

4.2.2 The appellant argued that the patent did not provide any indication that the mixed-metal oxide layer according to claim 1 could not be achieved when further components are present in the "composition comprising a trivalent chromium salt and an alkali metal hexafluorozirconate".

4.2.3 However, this view of the appellant is contrary to the common understanding of the skilled person regarding the underlying chemistry and the explicit teaching of D1 regarding the formation of a hydrophilic polymer film, which is not the same as a mixed-metal oxide layer. D1 does not disclose that a mixed-metal oxide layer is additionally achieved. Moreover, D1 does not disclose a coating composition comprising an alkali metal hexafluorozirconate as required by claim 1. Instead, hexafluorozirconic acid is used in Examples 2 to 4 of D1. Hence, the composition has a different pH and different reaction conditions from the one defined in claim 1. It follows that the appellant's argument is based on a speculative interpretation of D1 which extends beyond the direct and unambiguous disclosure of that document.

4.2.4 It is true that the patent discloses in paragraph [0022] that the coating compositions can comprise minor amounts (0.1 g to 10 g/l) of polymeric thickeners. However, the function and amount of a thickener are not the same as the use of a polymer for forming a polymeric layer. The use of minor amounts of thickeners according to the patent therefore cannot be expected to inevitably result in a polymeric coating as described in D1.

Moreover, the coatings comprising chromium obtained by D1 are not disclosed as having a thickness of 50 to 100 nm as required by claim 1. Such thickness values are not implicit, either. An alleged disclosure can only be considered "implicit" if it is immediately apparent to the skilled person that nothing other than the alleged implicit feature forms part of the disclosed subject-matter (Case Law of the Boards of Appeal, 10th edition, 2022, chapter I.C.4.3). This is not the case in D1, as can be seen from the various thickness values in Table 1 of D1 that do not fall within the claimed range. The hypothetical possibility that a coating having a thickness of 50 to 100 nm could be obtained according to D1 is not relevant for the assessment of novelty; only the direct and unambiguous disclosure is to be taken into account for this.

- 4.2.5 In view of the above, the Board concludes that the subject-matter of claim 1 further differs from the disclosure of D1 in that the trivalent chromium is present as a mixed-oxide layer having a thickness of 50 to 100 nm.

In line with the arguments of the parties, the same conclusion applies to the subject-matter of claim 13.

#### 4.3 Novelty over D6

- 4.3.1 The appellant raised the novelty objection based on D6 for the first time in the appeal proceedings. However, the question of its admittance does not need to be addressed as the objection does not hold.
- 4.3.2 D6 discloses a heat exchanger (see claim 1) that is particularly suitable for use in a refrigeration unit

with refrigerant circulating through the tubes (see paragraph [0003]). According to paragraph [0024] and claim 15 of D6, the heat exchanger can comprise a coating for enhancing corrosion resistance. The list of individual possible coatings to be used according to D6 includes trivalent chrome conversion coats and zirconium conversion coats.

D6 does not disclose

- the thickness of the conversion coating,
- the presence of an alkali metal hexafluorozirconate in the coating composition
- a coating of a mixed-metal oxide layer.

Moreover, D6 leaves open whether or not a further coat is applied on the conversion coating.

The argument by the appellant that on the date of filing of D6 trivalent chrome conversion coatings could (and in fact usually did) comprise an alkali metal hexafluorozirconate is a mere allegation that is not supported by verifiable facts. Therefore, the Board is not convinced that hexafluorozirconate is implicitly disclosed in D6 as part of the chromium (III) treatment solution. Furthermore, the hypothetical possibility that a coating having a thickness of 50 to 100 nm could be obtained according to D6 is not relevant for the assessment of novelty; only a direct and unambiguous disclosure is to be taken into account for this. There is also no evidence that the thickness of 50 to 100 nm was inevitably achieved.

- 4.3.3 The subject-matter of claim 1 therefore differs from the disclosure of D6 in that
- the coating composition comprises an alkali metal hexafluorozirconate

- a top surface coat is formed of a mixed-metal oxide layer
- the top surface coat has a thickness of 50 to 100 nm.

In line with the arguments of the parties, the same conclusion applies to the subject-matter of claim 13.

#### 4.4 Novelty over D9

4.4.1 D9 is a document of the respondent and it validly claims priority from document D9\*. D9\* has an earlier filing date (15 March 2012) than the priority of the patent (1 March 2013). It is thus common ground that D9 constitutes state of the art under Article 54(3) EPC.

4.4.2 D9 discloses a heat exchanger comprising an aluminium alloy, the exterior surface of which is coated with a layer derived from a composition comprising a trivalent chromium salt and an alkali metal hexafluorozirconate (by reference to the commercial product "SurTec 650" in paragraph [0012] of D9, see also D11, "composition": dipotassium hexafluorozirconate). The chromium conversion layer has an average thickness of 100 nm (see paragraph [0012] of D9).

This intermediate product is eventually further coated by a corrosion-inhibitive e-coat 16 and a corrosion-inhibitive top coat 18, see Figure 1 and claim 1 or 11.

Hence, according to D9, the final heat transfer system comprises a heat exchanger having a corrosion-inhibitive top coat 18 (see paragraph [0014], first three lines and last line) and a cured top coat 16 (see paragraph [0014], lines 9 to 11) on the conversion layer.

Thus, in accordance with the claim interpretation adopted in point 4.1 above, the subject-matter of claim 1 differs from the disclosure of D9 in that the mixed-metal oxide layer (chromium conversion layer) is the top surface coat.

- 4.4.3 The appellant argued that the subject-matter of claim 1 was not novel over the heat exchanger obtained according to D9 as an intermediate product which only comprised a chromium conversion layer.

This argument is not convincing since claim 1 does not define an isolated heat exchanger at an arbitrary stage of its manufacturing process but is instead directed to an assembled heat transfer system comprising the heat exchanger and a heat transfer fluid circulation loop.

- 4.4.4 The appellant argued that a further coating was merely optional according to D9 since paragraph [0012], last sentence, of D9 reads:

"Thereafter, in one exemplary embodiment, the conversion coated heat exchanger substrate (also called a conversion coated heat exchanger) is subjected to a corrosion inhibitive electro-coating 16 (or "e-coat" 16)."

In the view of the appellant, this disclosure of D9 inherently disclosed by reverse implication an embodiment of a heat exchanger without a further electro-coating 16 and hence a heat transfer system according to claim 1.

This argument is not convincing.

- 4.4.5 D9 leaves no doubt that the conversion coating in D9 is not the top coat. Figure 1 and claims 1 and 11 of D9

disclose that the conversion coating is further coated by a corrosion-inhibitive e-coat 16 and a corrosion-inhibitive top coat 18. By interpreting the last sentence of paragraph [0012] of D9 as an implicit disclosure of an embodiment without a further electro-coating 16 in the context of the invention as presented in D9, this disclosure would not fall within the scope of independent claims 1 and 11 of D9 since the conversion coating is not the top coat; it is further coated by a corrosion-inhibitive top coat 18 (and a corrosion-inhibitive e-coat).

Interpreting - in an alternative approach - the last sentence of paragraph [0012] of D9 merely in the context of the further disclosure of that paragraph, various selections would be required in order to arrive at the subject-matter of claim 1 of auxiliary request 2. It would be necessary to select 1) SurTec 650 as the coating composition being an alkali metal hexafluorozirconate, 2) the coating thickness of 100 nm, and 3) an embodiment which is only disclosed by reverse implication. Moreover, it would have to be decided not to apply the further corrosion-inhibitive top coat 18, contrary to the remaining teaching of D9.

Hence, the subject-matter of claim 1 of auxiliary request 2 is not directly and unambiguously disclosed in D9.

In line with the arguments of the parties, the same conclusion applies to the subject-matter of claim 13.

4.5 In summary, the claims according to auxiliary request 2 fulfil the requirements of Article 54 EPC.

5. Validity of the priority

The priority of the patent has been challenged by the appellant on the assumption that the priority document of D9 (D9\*), and not the priority claimed in the patent, is the first application under Article 87(1) EPC.

Since the claimed subject-matter is novel over D9 and D9 and D9\* have undisputedly the same disclosure, the patent's claimed priority is the first application under Article 87(1) EPC. Thus, the priority is validly claimed by the patent.

It follows that D9 is merely state of the art under Article 54(3) EPC and is not relevant for the assessment of inventive step, which will be addressed in the following.

6. Auxiliary request 2 - inventive step

6.1 D6 as the closest prior art

6.1.1 D6 discloses a heat exchanger (see claim 1) that is particularly suitable for use in a refrigeration unit with refrigerant circulating through the tubes (see paragraph [0003]). According to paragraph [0024] and claim 15 of D6, the heat exchanger can comprise a coating for enhancing corrosion resistance.

6.1.2 As discussed above, the subject-matter of claim 1 differs from the disclosure of D6 in that

- the coating composition comprises an alkali metal hexafluorozirconate
- a top surface coat is formed of a mixed-metal oxide layer

- the top surface coat has a thickness of 50 to 100 nm.

- 6.1.3 The conversion coating proposed by D6 provides the same anti-corrosion effect as the mixed-metal oxide layer defined in claim 1. Moreover, the patent does not demonstrate that a coating having a thickness of 50 to 100 nm provides an unexpected or improved effect regarding the corrosion resistance.
- 6.1.4 Hence, the objective technical problem to be solved in view of D6 can be seen as the provision of an alternative coating for the aluminium alloy of the heat exchanger of the heat treatment system.
- 6.1.5 The subject-matter of claim 1 is not obvious to a skilled person starting from D6 even when considering common general knowledge, because it has not been demonstrated that it is known from common general knowledge that a conversion coat as defined in claim 1 can be used as a top surface coat.
- 6.1.6 This information is not derivable from D5, either. First, D5 does not relate to the field of heat exchangers but to the field of aircrafts. Since the size, temperatures and conditions during use and the type of aluminium alloys for an aircraft are considerably different from that of a heat exchanger, the skilled person would have no motivation to apply the conversion coating of an aircraft to a heat exchanger without hindsight.
- 6.1.7 Moreover, even if the skilled person had considered D5, this document does not provide the necessary information to use the conversion coating described therein as the only (top) coat since D5 teaches that the conversion coating is an undercoat or pre-treatment

(see D5, column 1, lines 32 to 34, and column 2, lines 41 to 57) which improves adhesion properties for further layers such as paint. The argument that the person skilled in the art would have omitted the addition of further layers in order to obtain a thinner coating allowing better heat transfer presupposes an application in the field of heat exchangers as well as the assumption that the pre-treatment undercoat is effective as a single corrosion-resistant top coat. There is no basis in D5 for either, and thus the argument is hindsight-driven.

A combination of D6 with D5 would therefore not have led to the heat transfer system of claim 1.

- 6.1.8 It follows that the subject-matter of claim 1 is not obvious when starting from document D6 even when considering D5.

The same reasoning applies to the method according to claim 13.

- 6.2 D1 as the closest prior art

- 6.2.1 D1 (referred to in paragraph [0004] of the patent) discloses a coating solution comprising chromium (III), zirconium and a polymer which forms a hydrophilic film.

D1 therefore relates to a different type of coating from the patent, which describes a mixed-metal oxide layer, see point 4.2 above. It is not apparent why the skilled person would be motivated to abandon the polymeric layer with its beneficial properties in favour of a mixed-metal oxide layer.

The argument of the appellant is thus based on hindsight and is not convincing.

Moreover, there is no reason to consult D5, or to combine the teaching of D1 with the disclosure of D5, for the same reasons as those set out above in relation to D6 as the starting point.

6.2.2 It follows that the subject-matter of claim 1 is not obvious when starting from document D1. The same reasoning applies to the method according to claim 13.

6.3 D3a as the starting point

6.3.1 D3a discloses a heat transfer system comprising an aluminium alloy conversion coating which can be formed using chromium acid chromate or phosphoric acid chromate solutions (see claim 1, for example). Hence, D3a addresses a different coating system from that described in the patent since the coating composition of D3a is based on hexavalent chromium (chromium acid chromate or phosphoric acid chromate) instead of trivalent chromium as according to the patent.

Thus, D3a is not a realistic starting point for the assessment of inventive step.

6.3.2 Even if the skilled person were to start from D3a, it is unlikely that they would change the coating system and replace the coating compositions comprising the hexavalent chromium with a composition as defined in claim 1 as it has not been demonstrated that it is known from common general knowledge or from D5 that a conversion coat as defined in claim 1 can be used as a top surface coat.

The argument of the appellant is thus based on hindsight and is not convincing.

6.3.3 It follows that the subject-matter of claim 1 is not obvious when starting from document D3a either. The same reasoning applies to the method according to claim 13.

6.4 In summary, the Board concludes that the subject-matter of the claims of auxiliary request 2 is not obvious in view of the cited prior art and thus fulfils the requirements of Article 56 EPC. In view of this finding and the required adaptations to be made by the respondent to the description, auxiliary request 2 is found to be allowable.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent in amended form based on
  - the claims of auxiliary request 2 as filed with the reply to the grounds of appeal of 12 October 2023,
  - page 3 to 5 of the specification as granted and
  - amended page 2 of the description as filed on 10 January 2025 during the oral proceedings before the Board and
  - Figures 1 to 4 of the specification.

The Registrar:

The Chairman:



C. Spira

C. Herberhold

Decision electronically authenticated