

Internal distribution code:

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

**Datasheet for the decision
of 22 April 2024**

Case Number: T 2169/21 - 3.2.03

Application Number: 08708087.5

Publication Number: 2106310

IPC: B22C1/10, B22C1/20, B22C9/12,
B22D15/00, B22D29/00, B22C1/16

Language of the proceedings: EN

Title of invention:
USE OF AMINE BLENDS FOR FOUNDRY SHAPED CORES AND CASTING
METALS

Patent Proprietor:
ARKEMA FRANCE

Opponents:
Bröcher, Dirk Joachim
BASF SE

Headword:

Relevant legal provisions:
EPC Art. 56
RPBA 2020 Art. 12(4), 13(2)

Keyword:

Inventive step - (no) - effect not made credible within the whole scope of claim - reformulation of the technical problem
Amendment to case - amendment within meaning of Art. 12(4) RPBA 2020

Amendment to case - reasons for submitting amendment in appeal proceedings (yes)

Amendment after summons - taken into account (yes) - cogent reasons (yes)

Decisions cited:

G 0007/93, T 1776/18

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
Fax +49 (0)89 2399-4465

Case Number: T 2169/21 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 22 April 2024

Appellant: ARKEMA FRANCE
(Patent Proprietor) 420, rue d'Estienne d'Orves
92700 Colombes (FR)

Representative: Bandpay & Greuter
11 rue Christophe Colomb
75008 Paris (FR)

Appellant: Bröcher, Dirk Joachim
(Opponent 1) Roswithastraße 11
45131 Essen (DE)

Representative: Gille Hrabal Partnerschaftsgesellschaft mbB
Patentanwälte
Brucknerstraße 20
40593 Düsseldorf (DE)

Appellant: BASF SE
(Opponent 2) 67056 Ludwigshafen (DE)

Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted on
22 October 2021 concerning maintenance of the
European Patent No. 2106310 in amended form.

Composition of the Board:

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

Summary of Facts and Submissions

- I. European patent No. 2 106 310 B1 ("the patent") relates to the use of amine blends as curing agents for binder compositions useful in the foundry art for making cores that harden at room temperature.
- II. Two oppositions were filed against the patent on the grounds of Article 100(b) EPC and Article 100(a) EPC together with Articles 54 and 56 EPC.
- III. The following documents, *inter alia*, were cited during the opposition proceedings:
- D1: JP 2005/329408 A
 - D1a: English machine translation of D1
 - D3: US 4,517,222
 - D4: EP 0 811 027 B1
 - D5: VDG-Merkblatt URETHAN-COLD-BOX-VERFAHREN, R305, February 1998
 - D6: Giessereitechnik kompakt, Werkstoffe, Verfahren, Anwendungen, 2003, Giesserei-Verlag GmbH, Düsseldorf, pages 91 to 93
 - D13: WO 96/26231 A1 (family member of D4)
 - D14: WO 95/05409 A1
 - D15: WO 98/06766 A2
 - D20: WO 2005/092539 A1
 - D27: Declaration of Mr Ruppin dated 04.08.2020
 - D27a: Report "Olfactive evaluation of amine catalysts", by Odournet France from 20.09.2016.

D29: Olfasense, experimental report 1434-2021-00 from 19.05.2021, "Determination of the Hedonic Curve according to VDI 3882-2 of three Odorous Substances:

- Dimethylethylamine
- Dimethylpropylamine
- Mixture"

- IV. The opposition division concluded that
- the ground for opposition under Article 100(b) EPC did not prejudice the maintenance of the patent
 - the subject-matter of claim 1 lacked novelty over the following documents: D1, D3-D6, D13, D14 and D20
 - the subject-matter of claims 1 and 8 of auxiliary request 1 was not novel over D5, D13, D14 or D20
 - the subject-matter of claims 1 and 7 of auxiliary request 2 lacked novelty over D5 and D20
 - the subject-matter of claims 1 and 4 of auxiliary request 3 lacked novelty over D5
 - the subject-matter of claims 1 and 3 of auxiliary request 4 was obvious in view of D5.

In its interlocutory decision the opposition division held that the claims according to auxiliary request 5 then on file met the requirements of the EPC.

- V. The interlocutory decision was appealed by all three parties. Therefore, for the sake of simplicity, the Board will refer to the parties as "the patent proprietor" and "the opponents" ("opponent 1" and "opponent 2").

VI. Initial requests

The patent proprietor requested that the decision under appeal be set aside and that the patent be maintained as granted (main request). In the alternative, it requested that the patent be maintained in amended form on the basis of one of auxiliary requests 1 to 16 as submitted with its reply to the appeal. Auxiliary request 7 as submitted with the reply corresponds to auxiliary request 5 as filed in the opposition proceedings, which the opposition division found to comply with the requirements of the EPC.

Both opponents requested that the decision under appeal be set aside and that the patent be revoked.

VII. The following documents were filed for the first time in the appeal proceedings, namely with the reply to appeal

- by opponent 1:

D33: Article from Chemgapedia: "Chemie für Mediziner: Funktionelle Gruppen"

- by opponent 2:

D31: Olfasense, experimental report 1638-2022-01 from 22.06.2022,

"Determination of Hedonic Tone and Level of Annoyance of three odorous Substances:

- Dimethylethylamine (DMEA)
- Dimethylpropylamine (DMPA)
- Mixture of 20% DMEA and 80% DMPA"

D32: P.R. Carey, J. Archibald "Sand Binder Systems", ASK Chemicals (no publication date)

VIII. With the summons to oral proceedings, the Board sent a communication under Article 15(1) RPBA to the parties, setting out its preliminary, non-binding opinion that none of the claim requests submitted by the patent proprietor was allowable.

IX. With a letter dated 28 August 2023, opponent 2 filed

D34: Declaration by Mr. M. Christophe Ruppin dated
14 May 2019

D34 provides further experimental data obtained by the patent proprietor, which had been submitted in parallel proceedings in the US.

X. With a letter dated 14 February 2024 the patent proprietor withdrew its appeal and stated that it would not be attending the oral proceedings.

As a consequence of the withdrawal of the appeal by the patent proprietor, the main request and auxiliary requests 1 to 6 no longer form part of the appeal proceedings. The numbering of the remaining requests to be discussed in the present decision has been retained for the sake of consistency with the written submissions of the parties.

XI. Opponent 1 also withdrew its appeal by letter dated 5 March 2024 and confirmed that it would not be attending the oral proceedings.

XII. The summons to oral proceedings was subsequently cancelled.

XIII. Wording of the independent claims of the requests at issue in the present decision

(a) Auxiliary request 7

This request corresponds to auxiliary request 5 as filed in the opposition proceedings, which the opposition division considered to comply with the requirements of the EPC.

Claim 1 reads:

"Use of a blend of at least two tertiary amines as catalyst for curing a composite resin composition, which is a foundry shape by the cold box process,

the blend of amines are chosen from DMEA-DMIPA, DMEA/DMPA, the blend containing from 10 to 30 parts by weight of DMEA to the total of the amine blend,

the blend of amines are chosen from DMEA-DEMA, and DMEA-TEA, the blend containing from 10 to 50 parts by weight of DMEA to the total of the amine blend,

DMEA being dimethylethylamine, DMIPA being dimethylisopropylamine, DEMA being diethylmethylamine, DMPA being dimethyl-n-propylamine and TEA being triethylamine."

(b) Auxiliary request 8

Claim 1 corresponds to claim 1 of auxiliary request 7 except that the alternatives including "TEA" have been deleted.

(c) Auxiliary request 9

Claim 1 corresponds to claim 1 of auxiliary request 7 except that it has been specified that a blend of two tertiary amines is used ("at least" has been deleted).

(d) Auxiliary request 10

Claim 1 corresponds to claim 1 of auxiliary request 8 except that it has been specified that a blend of two tertiary amines is used ("at least" has been deleted).

(e) Auxiliary request 11

Claim 1 corresponds to claim 1 of auxiliary request 9 except that the following feature has been added:

"the binder system comprising at least one phenolic resin component and at least one isocyanate component."

(f) Auxiliary request 12

Claim 1 corresponds to claim 1 of auxiliary request 11 except that the alternatives including "TEA" have been deleted.

(g) Auxiliary request 13

Claim 1 corresponds to claim 1 of auxiliary request 7 except that it has been specified that a blend of two tertiary amines is used ("at least" has been deleted) and also the definition of the blends:

"the blend of amines are chosen from DMEA-DMIPA, DMEA/DMPA, the blend containing from 10 to 30 parts by weight of DMEA to the total of the amine blend, the blend of amines are chosen from DMEA-DEMA, and DMEA-TEA, the blend containing from 10 to 50 parts by weight of DMEA to the total of the amine blend"

has been replaced by the following definition:

"the blend of amines being chosen from 50/50 DMEA/DMIPA, 20/80 DMEA/DMIPA, 10/90 DMEA/DMIPA, 50/50 DMEA/DMPA, 20/80 DMEA/DMPA, 10/90 DMEA/DMPA, 50/50 DMEA/DEMA, 20/80 DMEA/DEMA, 10/90 DMEA/DEMA, 50/50 DMEA/TEA, 20/80 DMEA/TEA, 10/90 DMEA/TEA, 80/20 DMEA/TEA and 90/10 DMEA/TEA, preferably 20/80 DMEA/DMIPA, 20/80 DMEA/TEA and 80/20 DMEA/TEA".

(h) Auxiliary request 14

Claim 1 corresponds to claim 1 of auxiliary request 13 except that the alternatives including "TEA" have been deleted.

(i) Auxiliary request 15

Claim 1 corresponds to claim 1 of auxiliary request 13 except that the following feature has been added:

"the binder system comprising at least one phenolic resin component and at least one isocyanate component.".

(j) Auxiliary request 16

Claim 1 corresponds to claim 1 of auxiliary request 15 except that the alternatives including "TEA" have been deleted.

XIV. The arguments put forward by opponent 2 as the sole remaining appellant can be summarised as follows.

(a) Admittance of D27a and D29

D27a had been filed at a late stage of the opposition proceedings. The opposition division should not have admitted D27a, due to its late filing.

The opposition division exercised its discretion in an appropriate manner to admit D29.

(b) Admittance of D31, D32, D33 und D34

Documents D31 to D33 had been filed in response to events during the opposition proceedings and should thus be admitted into the appeal proceedings.

D34 was a declaration by an employee of the patent proprietor, and it reported on the experiments mentioned in D27 in combination with further experimental evidence obtained by the patent proprietor itself. D34 had been filed by opponent 2 in response to arguments presented by the patent proprietor in the appeal proceedings.

(c) Auxiliary requests 7 to 16 - inventive step

D5 proposed the use of amine blends as curing agents for binder compositions in the polyurethane cold-box process. Therefore, D5 belonged to the same technical

field as the patent and was a suitable starting point for the assessment of inventive step.

The experimental evidence as reported in the patent, as well as in D27, D27a and D34 demonstrated that the use of a blend of tertiary amines did not achieve a synergistic effect in terms of curing and olfactory properties.

Using arbitrary amounts of selected amines was within the customary practice adopted by the skilled person to provide an alternative catalyst for curing a composite resin composition.

(d) Auxiliary requests 11, 12, 15 and 16 - admittance

Auxiliary requests 11, 12, 15 and 16 did not address the objections raised by opponent 2 and hence did not comply with the requirements of Rule 80 EPC.

XV. The patent proprietor's arguments in response to the objections raised by opponent 2 can be summarised as follows.

(a) Admittance of D27a and D29

D29 had been filed at a late stage of the opposition proceedings. The opposition division should not have admitted D29, due to its late filing.

The opposition division exercised its discretion in an appropriate manner to admit D27a.

(b) Admittance of D31, D32 and D33

These documents could and should have been submitted during the opposition proceedings.

(c) Auxiliary requests 7 to 16 - inventive step

D5 was not a suitable starting point, since it did not relate to the same specific purpose as the patent. Only D15 should be considered as the closest prior art, since it addressed the problems associated with the odour of the amines generally used in the cold-box process and with the speed of hardening of the form - see page 2, line 31 - page 3, line 1, of D15.

The experimental evidence in D27 and D27a demonstrated that the use of a blend of tertiary amines achieved a synergistic effect regarding curing and olfactory properties.

This was not derivable from the cited prior art.

Reasons for the Decision

1. Decision in written proceedings

Both the patent proprietor and opponent 1 withdrew their appeals and confirmed that they would not be attending the oral proceedings. Their declarations confirming that they would not be attending are considered to constitute a withdrawal of their requests for oral proceedings (see Case Law of the Boards of Appeal, 10th edition, 2022, Chapter III.C.4.3.2).

Opponent 2's request for oral proceedings was filed subject to the Board not revoking the patent.

As the Board has decided to revoke the patent, therefore, the decision in the present case can be taken in written proceedings - in accordance with Article 12(8) RPBA 2020 and Articles 113 and 116 EPC - on the basis of the contested decision to be reviewed and the parties' written submissions.

2. Admittance of D27a and D29 by the opposition division

Documents D27a and D29 had been filed after the end of the time limits fixed under Article 99(1) EPC and Rule 79(1) EPC. The admittance of these documents was at the discretion of the opposition division (see T 1776/18, Reasons 4.6.4).

When exercising its discretion, the opposition division took into account the *prima facie* relevance of the late-filed documents. It follows that the opposition

division applied the correct criteria when exercising its discretion.

Therefore, the Board sees no reason to interfere with the exercise of discretion by the opposition division (G 7/93, point 2.6 of the reasons).

3. Admittance of D31, D32, D33 and D34

3.1 Documents D31 to D33 were filed by opponent 2 for the first time with its reply to the statement of grounds of appeal. For the following reasons, the Board takes the view that the filing of these documents constituted a justified reaction to procedural events occurring during the opposition proceedings.

D31 can be regarded as a justified reaction to the late filing of D27a during the opposition proceedings.

D32 and D33 illustrate common general knowledge of the physical properties of tertiary amines. The filing of these documents can be seen as a justified reaction to the argument put forward by the patent proprietor that the experimental results in D18 are not credible.

Since the physical properties of tertiary amines are not dependent on a publication date, the Board does not consider it appropriate to disregard D32 simply because its publication date is unknown.

Therefore, the Board decides to admit documents D31 to D33 into the appeal proceedings under Article 12(4) RPBA.

3.2 Document D34 was filed by opponent 2 shortly after the latter had received the Board's communication under Article 15(1) RPBA.

D34 supplements the main line of argument used by opponent 2 and presented throughout the entire appeal proceedings - namely that the experimental evidence does not show a synergistic effect for the curing efficiency of amine blends according to claim 1. Therefore, it does not change the matters to be discussed, and its admittance is not detrimental to procedural economy. D34 also confirms, *prima facie*, the preliminary conclusion presented by the Board in its communication under Article 15(1) RPBA, namely that the experimental evidence presented by the patent proprietor does not prove the presence of a synergistic effect.

Furthermore, D34 is a declaration which had been filed by the patent proprietor itself during parallel US proceedings. It was prepared by Mr Ruppin, an employee of the patent proprietor, from whom the comparative tests D27 as filed by the patent proprietor originated. In fact, D34 encompasses the experimental evidence set out in D27 but also contains further experimental evidence which had not been reported in D27.

Therefore, D34 cannot be expected to contain any information that is surprising for the patent proprietor.

3.3 The Board further notes that the patent proprietor did not provide any arguments concerning D34 - either in relation to its admittance or in relation to its substance - but withdrew its appeal and stated that it

would not be attending the oral proceedings a few months after D34 was filed by opponent 2.

3.4 In its overall assessment, the Board considers the above circumstances to constitute exceptional circumstances justifying the admittance of document D34 into the appeal proceedings under Article 13(2) RPBA.

4. Auxiliary request 7 - inventive step

4.1 Choice of closest prior art

4.1.1 The opponents and the opposition division concluded that D5 is a suitable starting point for the evaluation of inventive step.

The Board sees no reason to deviate from this assessment, since D5 explicitly relates to the use of amine blends as curing agents for binder compositions in the polyurethane cold-box process (D5, point 1). The latter is precisely the technical field of the invention in the present case (see [0001] and [0002] of the patent).

4.1.2 The patent proprietor argued that D5 was not a suitable starting point since it did not relate to the same specific purpose. The patent proprietor was of the view that only D15 should be considered as the closest prior art, since it addressed the problems associated with the odour of the amines generally used in the cold-box process and with the speed of hardening of the form - see page 2, line 31 - page 3, line 1 of D15.

This argument is not convincing.

4.1.3 Although D15 - in contrast with D5 - explicitly mentions the odour problem associated with the amines used in the cold-box process, this problem (ammonia or fish-like smell of short-chain alkylamines) is nevertheless well-known in the art. Indeed, it is an inherent property of this type of compound.

Moreover, the odour problem associated with the amines is also inherently reflected by D5 in the explanation contained therein, according to which the development of smell should be reported immediately (see D5, page 3, left column, sixth paragraph) and strict limits are to be respected for the amount of gas in the air - see point 6.3 of D5.

4.1.4 In view of the above, the Board concludes that D5 is a realistic starting point for the evaluation of inventive step.

4.2 Disclosure of D5

D5 discloses, in Chapter 3.1.3, tertiary amines which act as catalysts for the cold-box process (see Chapter 1). More specifically, it discloses that

- triethylamine (TEA)
- dimethylethylamine (DMEA)
- dimethylisopropylamine (DMIA)

or mixtures thereof can be used as catalysts.

4.3 Distinguishing features

Starting from D5, the subject-matter of claim 1 differs in that the blend of amines is chosen from

- DMEA-DMIPA, DMEA/DMPA, the blend containing from 10 to 30 parts by weight of DMEA to the total of the amine blend or

- DMEA-DEMA, and DMEA-TEA, the blend containing from 10 to 50 parts by weight of DMEA to the total of the amine blend.

4.4 Alleged synergy in terms of curing

4.4.1 The patent proprietor argues that a combination of tertiary amines provides a synergistic effect in terms of curing and that the objective technical problem can be seen as providing a binder system having improved curing properties.

This argument is not convincing.

4.4.2 Experimental results in the patent

As far as the experimental results in Tables 1 and 2 of the patent are concerned, it is undisputed that the experimental data in Tables 1 and 2 of the patent itself are not suitable for the purpose of demonstrating a synergistic effect. Indeed, the theoretical mass of the blend required for 100% curing as referred to in Tables 1 and 2 has been wrongly determined.

In response to this finding, the patent proprietor filed D27 during the opposition proceedings.

4.4.3 Experimental results in D27

The annex of D27 contains a modified version of Table 2 of the patent, which has been supplemented by further columns:

Mixture DMEA/TEA 20/80									
Amine	Experimental mass (g) of DMEA required for 100% curing	Experimental mass (g) of TEA required for 100% curing	Expected mass (g) of 20/80 DMEA/TEA = 0.2 x Mass (g) of DMEA required for 100% curing + 0.8 x Mass (g) of TEA required for 100% curing, if no mutual influence of each amine on the other	Experimental mass (g) of 20/80 DMEA/TEA blend required for 100% curing	Mass of DMEA in experimental mass (g) of 20/80 DMEA/TEA blend = 0.2 x global experimental mass(g) of 20/80 DMEA/TEA	Mass of TEA in experimental mass (g) of 20/80 DMEA/TEA blend = 0.8 x global experimental mass(g) of 20/80 DMEA/TEA	Ratio of expected curing with this experimental mass of DMEA = (mass of DMEA in experimental mass (g) of 20/80 DMEA/TEA blend) / (experimental mass (g) of DMEA required for 100% curing)	Ratio of expected curing with this experimental mass of TEA = (mass of DMEA in experimental mass (g) of 20/80 DMEA/TEA blend) / (experimental mass (g) of TEA required for 100% curing)	Ratio of total expected curing with this experimental mass of 20/80 DMEA/TEA blend
Resin									
Avecure 373/673	0,3729	0,9464	0,8317	0,612	0,122	0,490	32,8%	51,7%	84,6%
Avecure 353/653	0,3051	1,4560	1,2258	0,936	0,187	0,749	61,4%	51,4%	112,8%
Avecure 333/633	0,3051	1,4560	1,2258	0,792	0,158	0,634	51,9%	43,5%	95,4%
Avecure 331/631	0,3390	1,4560	1,2326	0,936	0,187	0,749	55,2%	51,4%	106,6%
Avecure 363/663	0,2034	0,9464	0,7978	0,360	0,072	0,288	35,4%	30,4%	65,8%

and further experimental results for the following blends of tertiary amines

- 50/50 DMEA/DEMA
- 20/80 DMEA/DEMA
- 10/90 DMEA/DEMA
- 20/80 DMEA/DMIPA
- 20/80 DMEA/DMPA.

According to the patent proprietor the alleged synergistic effect can be seen in the column "ratio of total expected curing with this experimental mass ...". A ratio of 100% reflects curing as expected. A ratio of less than 100% is a sign of a synergistic effect.

For the following reasons, the Board agrees with the conclusion of the opposition division, namely that the effects demonstrated in D27 do not render it credible that the synergistic effect in terms of reactivity is achievable over the whole scope of the claim.

A) doubts generated by D27

The experimental results reported in D27 demonstrate that the choice of amine and also the amounts thereof

(ratio of amines) have a great impact on the curing properties.

D27 confirms that it is not even possible to achieve a synergistic effect for the same tertiary amine blend (e.g. DMEA/DMPA 20/80) for different products (Avecure xxx/yyy) of the same binder system (the Avecure system).

Indeed, the last table on page 6 of D27 indeed confirms that, for Avecure 373/673, the "ratio of total expected curing with this experimental mass of 20/80 DMEA/DMPA blend" is clearly below 100% and therefore could be regarded as a sign of a synergistic effect. However, for Avecure 331/631, the same ratio is 102.5% and thus even suggests a worsening of the curing properties obtained by the blend.

A similar observation can be made for the results of the blend DMEA/TEA 20/80 (D27, page 5, first table). It follows that the results reported in the table on page 6 of D27 vary to a great extent from one resin to the other.

Therefore, D27 supports the Board's understanding that a surprising synergistic effect observed for a specific combination of actives cannot be generalised.

In addition to the experimental results obtained for the "ratio of total expected curing with this experimental mass" - which are clearly above and below 100% - the table on page 6 of D27 also shows results which are relatively close to 100%, such as 98.2% (Avecure 363/663, Mixture DMEA/DEMA 20/80).

As argued by opponent 2, it is questionable whether results that are very close to 100% support the presence of a synergistic effect. Indeed, the error margin for the experiments is relatively high due to the amines being dosed in portions of 50 μ l.

The patent proprietor confirms - by reference to paragraph [0091] of the patent - that, depending on the reactivity of the amines used as the catalyst, the quantity of the amines can range from 0.2 ml to 1.5 ml. The patent proprietor also thereby confirms that the syringe used to inject the amine mixture into the furnace has a volume of 50 μ l.

Hence, the error margin for loading a syringe is multiplied by the number of doses required to achieve 100% curing. Moreover, it follows from the fact that the last dose comprises 50 μ l that a certain error margin has to be taken into account. The influence of the dose volume on the error margin is also confirmed by the table on page 9 of the patent proprietor's reply to the statement setting out the grounds of appeal (in which D24 should be read as D27). In that table, the patent proprietor presents an overview of the results calculated by the opponent 2 using a 50- μ l dosage regime according to D27 and the corresponding results including an error margin for experiments using a syringe having a volume of only 10 μ l.

	Résultats D24	Résultats Opposant O2 50µL	Résultats Titulaire 10µL
	%	%	%
DMEA : DEMA 50 : 50			
336/633	96,2	87,4-106,2	94,4-98,0
331/631	88,1	80,8-96,2	86,6-89,6
363/663	83,8	69,8-98,1	81,0-86,3
DMEA : DEMA 20 : 80			
336/633	79,9	72,7-86,7	78,5-81,2
331/631	96,6	91,0-103,5	95,4-97,9
363/663	98,2	86,0-112,5	95,8-100,8
DMEA : DEMA 10 : 90			
336/633	87,9	81,2-94,7	86,6-89,2
331/631	92,2	87,1-97,8	91,1-93,2
363/663	93,6	81,9-106,3	91,3-95,9
DMEA : TEA 20 : 80			
373/673	84,6	79,6-89,9	83,6-85,6
353/653	112,8	108,5-121,8	111,9-114,4
336/633	95,4	91,1-103,0	94,6-96,8
331/631	106,6	102,6-114,1	105,8-108,0
363/663	65,8	59,3-74,1	64,5-67,2
DMEA : DMIA 20 : 80			
373/673	88,3	80,4-96,1	86,7-89,8
331/631	97,2	91,2-104,3	96,0-98,6
363/663	91,7	80,3-104,3	89,4-93,9
DMEA : DMPA 20 : 80			
373/673	95,8	87,8-104,1	94,2-97,3
331/631	102,5	95-110,0	101,3-103,9
363/663	98,0	85,8-112,4	95,6-100,6

This table confirms that - in the absence of a statistically significant error margin - examples resulting in a "ratio of total expected curing with this experimental mass" of, e.g., 98.2% or higher

cannot be deemed to show a synergistic effect either, since the alleged improvement is considerably smaller than the error margin.

In view of the above, the Board concludes that the further experimental results reported in D27 do not render it credible that, for the selected amines used in the experiments, a blend of tertiary amines in any ratio in any type of resin achieves a synergistic effect regarding curing.

B) doubts confirmed by D34

The doubts generated by D27 are further confirmed by D34.

D34 is a declaration by the author of D27. D34 discloses, in rows 1, 4 and 5 of Table C, the experimental results of D27 as regards the blend of DMEA/DMPA 20/80 - see last table on page 6 of D27. However, Table C of D34 additionally reports - in row 2 (binder system Avecure 353/653) and row 3 (binder system Avecure 333/633) - on the results of further experiments relating to a blend of DMEA/DMPA 20/80.

See also D27, page 6, last table:

Mixture DMEA/DMPA 20/80									
Amine	Experimental mass (g) of DMEA required for 100% curing	Experimental mass (g) of DMPA required for 100% curing	Expected mass (g) of 20/80 DMEA/DMPA = 0.2 x Mass (g) of DMEA required for 100% curing + 0.8 x Mass (g) of DMPA required for 100% curing, if no mutual influence of each amine on the other	Experimental mass (g) of 20/80 DMEA/DMPA blend required for 100% curing	Mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend = 0,2 x global experimental mass(g) of 20/80 DMEA/DMPA	Mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend = 0.8 x global experimental mass(g) of 20/80 DMEA/DMPA	Ratio of expected curing with this experimental mass of DMEA = (mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of DMEA required for 100% curing)	Ratio of expected curing with this experimental mass of DMPA = (mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of TEA required for 100% curing)	Ratio of total expected curing with this experimental mass of 20/80 DMEA/DMPA blend
Resin									
Avecure 373/673	0,3729	0,4570	0,4402	0,4188	0,0838	0,3350	22,5%	73,3%	95,8%
Avecure 331/631	0,3390	0,7030	0,6302	0,5933	0,1187	0,4746	35,0%	67,5%	102,5%
Avecure 363/663	0,2034	0,3164	0,2938	0,2792	0,0558	0,2234	27,5%	70,6%	98,0%

and D34, Table C, on page 4:

Table C

20 DMEA / 80 DMPA							
Resin	Optimized volume of DMEA for 100% curing	Mass of DMEA required for 100% curing = $V_{opt.} \times d_{DMEA} = 0,678$	Optimized volume of DMPA for 100% curing = $V_{opt.}$	Mass of DMPA required for 100% curing = $V_{opt.} \times d_{DMPA} = 0,703$	Optimized required volume of 20/80 DMEA/DMPA experimental	Experimental mass of 20/80 DMEA/DMPA = $V_{opt.20/80} \times d$ (d = 0,698 ; theoretical blend density)	Theoretical mass of 20/80 DMEA/DMPA = $0,2 \times$ mass of DMEA required for 100% curing + $0,8 \times$ mass of DMPA required for 100% curing
373 / 673	0,55	0,3729	0,65	0,4570	0,60	0,4188	0,4401
353 / 653	0,45	0,3051	0,80	0,5624	0,70	0,4886	0,5109
333 / 633	0,45	0,3051	0,90	0,6327	0,80	0,5504	0,5672
331 / 631	0,50	0,3390	1,00	0,7030	0,85	0,5933	0,6302
363 / 663	0,30	0,2034	0,45	0,3164	0,40	0,2792	0,2938

The ratio of total expected curing with this experimental mass of 20/80 DMEA/DMPA blend can be calculated by analogy with D27 (including the error margins as discussed above) also for the additional experiments contained in D34 - see point [10] of the submission of opponent 2 dated 28 August 2023.

For the binder system Avecure 353/653 the ratio is 101.5%, and for the binder system Avecure 333/633 the ratio is 107.2%.

Mixture DMEA/DMPA 20/80										
Amine	Resin	Experimental mass (g) of DMEA required for 100% curing	Experimental mass (g) of DMPA required for 100% curing	Expected mass (g) of 20/80 DMEA/DMPA = $0,2 \times$ Mass (g) of DMEA required for 100% curing + $0,8 \times$ Mass (g) of DMPA required for 100% curing, if no mutual influence of each amine on the other	Experimental mass (g) of 20/80 DMEA/DMPA blend required for 100% curing	Mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend = $0,2 \times$ global experimental mass(g) of 20/80 DMEA/DMPA	Mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend = $0,8 \times$ global experimental mass(g) of 20/80 DMEA/DMPA	Ratio of expected curing with this experimental mass of DMEA = (mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of DMEA required for 100% curing)	Ratio of expected curing with this experimental mass of DMPA = (mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of TEA required for 100% curing)	Ratio of total expected curing with this experimental mass of 20/80 DMEA/DMPA blend
	353/653	0,3051	0,5624	0,4886	0,09772	0,39088	32,0	69,5	101,5	94,3 - 110,2
	333/633	0,3051	0,6327	0,5584	0,11168	0,44672	36,6	70,6	107,2	100,5 - 115,9

Similar observations apply in relation to the DMEA-DEMA (20/80) amine blend - see D34, Table A, which reports on additional experiments with further binder systems such as Avecure 353/653 and Avecure 325/625.

Table A

20 DMEA / 80 DEMA							
Resin	Optimized required volume of DMEA for 100% curing	Mass of DMEA required for 100% curing = $V_{opt} \times d_{DMEA} = 0.678$	Optimized volume of DEMA for 100% curing = V_{opt}	Mass of DEMA required for 100% curing = $V_{opt} \times d_{DEMA} = 0.707$	Optimized required volume of 20/80 DMEA/DEMA, experimental	Experimental mass of 20/80 DMEA/DEMA = $V_{opt, 20/80} \times d$ (d = 0.702 ; experimental blend density)	Theoretical mass of 20/80 DMEA/DEMA = 0.2 x mass of DMEA required for 100% curing + 0.8 x mass of DEMA required for 100% curing
373 / 673	0.55	0.3729	0.65	0.45855	0.60	0.4212	0.44222
353 / 653	0.45	0.3051	0.80	0.5656	0.70	0.4914	0.5135
333 / 633	0.45	0.3051	0.80	0.5656	0.55	0.3861	0.5135
331 / 631	0.50	0.3390	1.10	0.7777	0.85	0.5967	0.68996
325 / 625	0.30	0.2034	1.10	0.7777	0.70	0.4914	0.66284
363 / 663	0.30	0.2034	0.45	0.31815	0.40	0.2808	0.2952

Once again, the ratio of total expected curing with this experimental mass of 20/80 DMEA/DEMA blend can be calculated by analogy with D27 also for the additional experiments reported in D34 in Table A - see point [12] of the submission of opponent 2 dated 28 August 2023.

Mixture DMEA/DMPA 20/80									
Amine	Experimental mass (g) of DMEA required for 100% curing	Experimental mass (g) of DMPA required for 100% curing	Expected mass (g) of 20/80 DMEA/DMPA = 0.2 x Mass (g) of DMEA required for 100% curing + 0.8 x Mass (g) of DMPA required for 100% curing, if no mutual influence of each amine on the other	Experimental mass (g) of 20/80 DMEA/DMPA blend required for 100% curing	Mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend = 0.2 x global experimental mass(g) of 20/80 DMEA/DMPA	Mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend = 0.8 x global experimental mass(g) of 20/80 DMEA/DMPA	Ratio of expected curing with this experimental mass of DMEA = (mass of DMEA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of DMEA required for 100% curing)	Ratio of expected curing with this experimental mass of DMPA = (mass of DMPA in experimental mass (g) of 20/80 DMEA/DMPA blend) / (experimental mass (g) of TEA required for 100% curing)	Ratio of total expected curing with this experimental mass of 20/80 DMEA/DMPA blend
353/653	0,3051	0,5656	0,4914	0,09828	0,39312	32,2	69,5	101,7	94,5 - 110,4
325/625	0,2034	0,7777	0,4914	0,09828	0,39312	48,3	50,5	98,9	91,8 - 110,9

The ratio of total expected curing with this experimental mass can be calculated as 101.7% for Avecure 353/653 and 98.9% for Avecure 325/625.

Since a ratio of total expected curing with experimental mass of approximately 100% or above indicates the expected curing results, or even worse, the further experimental results obtained by the patent proprietor itself, and submitted by opponent 2 as D34, further confirm - in addition to D27 - that a synergistic effect in terms of curing cannot be

obtained over the claimed scope - not even for the preferred amine blends (DMEA/DMPA, DMEA/DEMA) in the preferred ratio (20/80).

4.5 Alleged synergy in terms of olfactory properties

4.5.1 The patent proprietor argues that a combination of tertiary amines provides a synergistic effect in terms of olfactory properties and that the objective technical problem to be solved can be seen as the provision of a binder system having a less unpleasant odour. In support of this allegation, the patent proprietor refers to the olfactory analytics reported on pages 3 and 4 of D27 and to the further experimental evidence presented in D27a.

For the reasons set out below, this argument is not convincing. The Board agrees with the conclusion of the opposition division that the effects demonstrated in D27 and D27a do not make it credible that the synergistic effect regarding the olfactory properties is achievable over the whole scope of protection.

4.5.2 D27 and D27a evaluate the intensity of the odour and the hedonic tone according to VDI 3882 (parts 1 and 2).

These documents demonstrate that, for a specific amine blend (30/70 DMEA/DMPA blend), an improvement in the olfactory properties can be achieved.

However, the Board is convinced that the perception of odour and the interaction of different smells vary from blend to blend. Even if a specific combination of amines in a specific ratio can be observed to have synergistically improved olfactory properties, the same effect cannot be expected for all combinations of

amines and for all ratios thereof, since the interaction of odour molecules cannot generally be extrapolated.

This assessment is confirmed by D29 and D31, which report - for a 20/80 DMEA/DMPA blend, hence a blend of the same amines as used for D27 and D27a but in a different ratio - that no synergistic improvement in the perception of odour can be observed - see, e.g., D31: diagrams on pages 7 and 8, and summary.

The Board therefore concludes that the experimental evidence presented by the patent proprietor does not render it credible that a synergistic effect regarding the olfactory properties can be achieved over the whole scope of the claim.

4.6 Obviousness in view of D5

Since no synergistic effect over the whole scope of the claims has been made credible by the experimental data on file (see discussion above), the objective technical problem in view of D5 has to be formulated in a less ambitious way, namely as the provision of an alternative.

Starting from the teaching in D5, according to which a mixture of tertiary amines is used, the skilled person has to use a certain quantity of each amine.

Selecting amines in arbitrary amounts as defined in claim 1 does not require inventive skills, but - instead - falls within the scope of experimental routine of the skilled person.

4.7 Therefore, the subject-matter of claim 1 of auxiliary request 7 is obvious when starting from D5, and it does not fulfil the requirements of Article 56 EPC.

5. Auxiliary requests 8 to 16 - inventive step

5.1 The subject-matter of the independent claims according to auxiliary requests 8 to 16 has been tailored - with varying levels of generality - to blends of tertiary amines which have been tested in D27, D27a and D34.

However, as discussed above in point 2.4, a synergy regarding curing has not been demonstrated for the specific blends tested in D27, D27a and D34 (see, e.g., 20/80 DMEA/DMPA blend in combination with AVECURE 331/631, AVECURE 353/653, AVECURE 333/633) and is hence not credible for the whole scope of the claim.

The same applies for a synergy regarding the olfactory properties, which is not considered to be achievable over the whole scope of the claim, as demonstrated by D31 - see point 2.5 above.

It follows that the subject-matter of claim 1 as defined in auxiliary requests 8 to 16 can be considered to solve the same objective technical problem as claim 1 of auxiliary request 7.

Hence, the same arguments apply for the subject-matter of auxiliary requests 8 to 16 as for auxiliary request 7.

5.2 Therefore, the subject-matter of claim 1 of each of auxiliary requests 8 to 16 is obvious when starting from D5 and does not fulfil the requirements of Article 56 EPC.

It follows that the question of whether auxiliary requests 11, 12, 15 and 16 should be admitted into the appeal proceedings does not need to be addressed.

Order

For these reasons it is decided that:

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

The Registrar:

The Chairman:



C. Spira

C. Herberhold

Decision electronically authenticated