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**Datasheet for the decision
of 31 January 2024**

Case Number: T 1138/21 - 3.3.03

Application Number: 13742626.8

Publication Number: 2879853

IPC: B29C44/34, B29C44/38,
B29C44/42, C08J9/12, C08G18/08

Language of the proceedings: EN

Title of invention:

METHOD FOR THE PRODUCTION OF POLYURETHANE FOAM USING
EMULSIFIED BLOWING AGENT

Patent Proprietor:

Covestro Deutschland AG

Opponent:

The Dow Chemical Company

Relevant legal provisions:

RPBA 2020 Art. 12(4)
EPC Art. 56

Keyword:

Inventive step - Main request (no) - Auxiliary requests 14 and
15 (no)
Amendment to case - amendment admitted - Auxiliary requests 14
and 15 (yes)



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Case Number: T 1138/21 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 31 January 2024

Appellant: The Dow Chemical Company
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted on 19 May 2021 rejecting the opposition filed against European patent No. 2879853 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman D. Semino
Members: D. Marquis
A. Bacchin

Summary of Facts and Submissions

I. The appeal of the opponent lies against the decision of the opposition division rejecting the opposition against European patent No. 2 879 853.

II. Claim 1 as granted reads as follows:

"1. A method for the production of polyurethane foam, comprising the steps of:

- providing an isocyanate-reactive component **A** comprising a polyol component **A1** which further comprises a physical blowing agent **T**;
- combining at least the isocyanate-reactive component **A** and an isocyanate component **B**, thereby obtaining a polyurethane reaction mixture;
- providing the polyurethane reaction mixture in a cavity; and
- reducing the pressure within the cavity to a pressure lower than ambient pressure;

characterized in that the physical blowing agent **T** is present in the isocyanate-reactive component **A** in the form of an emulsion with the polyol component **A1** constituting the continuous phase and droplets of the physical blowing agent **T** the dispersed phase of the emulsion, wherein the average size of the droplets of the physical blowing agent **T** is $\geq 0,1 \mu\text{m}$ to $\leq 20 \mu\text{m}$, the droplet size being determined by using an optical microscope operating in bright field transmission mode wherein the polyol **A1** comprises:

A1a: a polyether polyol with a hydroxyl number of ≥ 15

mg KOH/g to \leq 550 mg KOH/g and a functionality of \geq 1,5 to \leq 5,5 obtained by the addition of an epoxide to one or more starter compounds selected from the group of carbohydrates and/or at least difunctional alcohols; and

Alb: a polyether polyol with a hydroxyl number of \geq 100 mg KOH/g to \leq 550 mg KOH/g and a functionality of \geq 1,5 to \leq 5,0 obtained by the addition of an epoxide to an aromatic amine; and

Alc: a polyester polyether polyol with a hydroxyl number of \geq 100 mg KOH/g to \leq 450 mg KOH/g and a functionality of \geq 1,5 to \leq 3,5 obtained by the addition of an epoxide to the esterification product of an aromatic dicarboxylic acid derivative and an at least difunctional alcohol".

III. The decision under appeal was based *inter alia* on the following documents:

D1: US 7,943,679 B2

D4: WO 2011/137011 A1

D5: WO 2009/055436 A1

D16: "Anlage 1", filed with letter of 19 March 2021

D17: Additional examples 3 and 4 (comparative), filed with letter of 19 March 2021

IV. According to the reasons for the contested decision which are pertinent for the appeal proceedings, the subject-matter of the granted claims was sufficiently disclosed and involved an inventive step.

V. The opponent (appellant) lodged an appeal against the decision of the opposition division.

VI. The patent proprietor (respondent) filed 15 sets of claims as auxiliary requests 1 to 15 with the reply to

the statement of grounds of appeal.

- VII. Oral proceedings before the Board were held on 31 January 2024 during which the respondent withdrew auxiliary requests 1 to 13.
- VIII. The appellant requested that the decision under appeal be set aside and that the patent be revoked.
- IX. The respondent requested that the appeal be dismissed or that the patent be maintained on the basis of any of auxiliary requests 14 and 15 filed with the reply to the statement of grounds of appeal.

Claim 1 of auxiliary request 14 corresponded to granted claim 1 further modified in that in the component Alc "the epoxide is used in such an amount that the content of oxyethylene groups is 5 mass-% to 50 mass-% with respect to the total mass of polyol Alc".

Claim 1 of auxiliary request 15 was identical to claim 1 of auxiliary request 14.

- X. The parties' submissions, in so far as they are pertinent, may be derived from the reasons for the decision below. The disputed points concerned inventive step of claim 1 of the main request in view of D1 chosen as the document representing the closest prior art, the admittance of auxiliary requests 14 and 15 into the proceedings and the question of inventive step of claim 1 of these requests in view of D1.

Reasons for the Decision

Main request (claims as granted)

1. Inventive step in view of D1
 - 1.1 The opposition division came to the conclusion that granted claim 1 involved an inventive step starting from D1 as the closest prior art (sections 7.2-7.5 of the reasons for the decision). The appellant contested that conclusion.
 - 1.2 The patent describes in paragraph 2 that it has been reported in the manufacturing of polyurethane foams from an isocyanate component and a polyol component in the presence of a physical blowing agent that improved thermal isolation was achieved if the blowing agent was dispersed as fine droplets in the polyol component.
 - 1.3 Document D1, and specifically Example 4 thereof, was considered as the closest prior art. Similarly to the patent in suit, D1 relates to the production of polyurethane foams, and in particular to polyurethane foams having reduced thermal conductivity (column 1, lines 5-7 of D1). D1 therefore belongs to the same technical field as the patent in suit and is directed to a similar purpose. D1 therefore represents a suitable starting point for the consideration of inventive step.
 - 1.4 D1 discloses, according to the language of operative claim 1, a method for the production of a polyurethane foam comprising the steps of: providing an isocyanate-reactive component A comprising a polyol component A1

which further comprises a physical blowing agent T; combining at least the isocyanate-reactive component A and an isocyanate component B, thereby obtaining a polyurethane reaction mixture; providing the polyurethane reaction mixture in a cavity; and reducing the pressure within the cavity to a pressure lower than ambient pressure (see claim 1 of D1).

1.5 The method disclosed in Example 4 of D1 was found to be the most relevant starting point within D1 by the opposition division. Example 4 of D1 (Table 4) discloses the preparation of a polyurethane foam by reaction of a polymeric methyldiisocyanate (Voratec SD 100, see column 11, line 34) with a mixture of polyols (Voranol RN 482, Voranol CP 1055 and Tercanol 5903) and cyclopentane as a blowing agent. It is derived from the description of the polyols in column 11, lines 18 to 30 that Voranol RN 482 and Voranol CP 1055 are components according to the definition of the polyol Ala in operative claim 1 while Tercanol 5903 is a component according to the definition of the polyol Alb.

1.6 The decision established that the method of Example 4 of D1 did not disclose an emulsion formed by the polyols and the blowing agent as required by granted claim 1 and did not disclose a polyol of the type Alc. The parties declared that they were in agreement with these findings in the decision under appeal at the oral proceedings before the Board. The Board taking into account the analysis above has no reason to disagree with this conclusion.

1.7 For the formulation of the technical problem the evidence in the patent in suit and the supplementary evidence provided in D16 and D17 have to be taken into account. In this respect, it is established case law

that where comparative tests are submitted as evidence of an unexpected effect, these tests have to show the closest possible structural approximation in a comparable type of use to the subject-matter claimed. In particular, if comparative tests are chosen to demonstrate an inventive step on the basis of an improved effect over a claimed area, the nature of the comparison with the closest state of the art must be such that the alleged advantage or effect is convincingly shown to have its origin in the distinguishing feature of the invention compared with the closest state of the art (Case Law of the Boards of Appeal, 10th Edition 2022, I.D.4.3.2).

- 1.7.1 The patent in suit contains two examples of methods according to granted claim 1 (Examples 2 and 4) and two comparative examples (Examples 1 and 3). However, as submitted by the appellant, Example 2 and comparative Example 1 cannot show the presence of an effect linked to the distinguishing features since the mixture of polyols used in the example and in the comparative example not only differed in the polyol A1c (polyol 3 in the examples) but also in the amounts and nature of the other polyols (comparative Example 1 discloses the use of 35 parts of polyol 1, 40 parts of polyol 4 and 25 parts of polyol 5 whereas example 2 discloses the use of 40 parts of polyol 1, 12 parts of polyol 2, 40 parts of polyol 3 and 8 parts of polyol 5). As additionally submitted by the appellant, there were also differences in the amount of water, catalyst, blowing agent and isocyanate index between the methods of Example 2 and comparative Example 1. In Example 3 (comparative) and Example 4 the same emulsion polyol system was used (Table 3), the examples differing in the conditions applied (standard conditions in example 3 and reduced pressure conditions in example 4) during

cabinet filling with the foaming process. Examples 3 and 4 of the patent in suit therefore do not pertain to the distinguishing features with respect to the closest prior art (Example 4 of D1). Examples 3 and 4 of the patent in suit are therefore not relevant to the present question of inventive step. The comparison made in the examples of the patent in suit is therefore not suitable to establish the presence of an effect resulting from any of the distinguishing features i) or ii) over the closest prior art.

1.7.2 With regard to the supplementary evidence contained in D16 and D17 the following is noted:

(a) D16 shows the identity of the polyols 1, 2, 3 and 5 used in a method according to granted claim 1 (example 2) in which an emulsion of blowing agent in the polyol was used (emulsion system (2)) compared to a method in which a soluble polyol formulation (1) was used instead. With respect to the comparison of examples 1 and 2 in D16, it is apparent that the formulations used do not only differ from one another in the form of their mixture (emulsion or solution) but that they also differ in a number of other essential elements, such as in the nature and amounts of the polyols, the amount of water and amine catalyst, blowing agent and isocyanate. The comparison of Examples 1 and 2 in D16 therefore does not provide a fair comparison of a method according to granted claim 1 with a method representing the closest prior art D1 and therefore cannot show that the distinguishing features result in an effect over D1.

(b) D16 contains two further examples (Examples 3 and 4) in which it is apparent from table 3 that the

polyol systems that were used were identical (polyol system 2 containing the polyols 1, 2, 3 and 5), the examples differing in the conditions applied (standard conditions in Example 3 and reduced pressure conditions in Example 4) during cabinet filling with the foaming process. Examples 3 and 4 of D16 therefore do not pertain to the distinguishing features with respect to the closest prior art (Example 4 of D1). Examples 3 and 4 of D16 are therefore not relevant to the present question of inventive step.

- (c) D17 contains an example (Example 3) and a comparative example (Example 4) and shows the preparation of polyurethanes based on the reaction of polyol mixtures containing pentane as a blowing agent and a polyisocyanate (Desmodur 44 V 20 L). The polyol mixtures in these examples are based on 50 parts of a polyol A (defined on page 2 and representing A1a in operative claim 1), 25 parts of a polyol B (defined on page 2 and representing A1b in operative claim 1) and 25 parts of a polyester polyether C (in Example 3, for which the hydroxyl number and the functionality are not given in D17) or alternatively 25 parts of Stepanpol PS2352 (in comparative Example 4, which composition and properties are not given). Even if the polyester polyether C and Stepanpol PS2352 used in the compositions of D17 are seen as representing the polyol component A1c according to operative claim 1, there is no information in D17 on how these polyol components differed from one another and therefore it cannot be concluded that any effect observed in D17 results from one of the distinguishing features over D1. Furthermore, the appellant argued at the oral proceedings before the

Board that the method shown in comparative Example 4 of D17 was not representative of the method of Example 4 of D1 because the polyol mixture used in the method of D17 did not represent that of the closest prior art. The respondent did not contest that argument. The Board also finds that, since the whole polyol mixture of comparative Example 4 in D17 differs significantly from that used in Example 4 of D1 and the selection of the polyol mixture and in particular its component corresponding to polyol Alc was considered by the respondent to be paramount to the alleged effect (rejoinder, page 9, section 2.2.3), the method of comparative Example 4 of D17 cannot be seen as a fair representation of a method using the polyol mixture of the closest prior art that can establish the presence of an effect over that method.

1.7.3 In the absence of a demonstration that any of the distinguishing features taken alone or in combination is causally linked to an effect over the method disclosed in Example 4 of D1, the problem solved over D1 can only be formulated as the provision of a further method for the production of polyurethane foams under reduced pressure.

1.8 D1 relates, as specified above, to the production process of polyurethane foams from polyisocyanates, a polyol composition and a physical blowing agent (claim 1), and in particular to polyurethane foams having reduced thermal conductivity (column 1, lines 5-7 of D1). The passage starting on column 6, line 58 of D1 concerns the physical blowing agents that can be used in the process of D1. On column 7, lines 47-54 D1 teaches that the blowing agent may be in the form of an emulsion in the polyol system. There is no teaching in

D1 from which it could be concluded that the skilled person would not have considered an emulsion of blowing agent in the polyol system as being applicable to Example 4 found to be the most relevant starting point in D1. It is also apparent that the droplet size defined in granted claim 1 ($\geq 0.1 \mu\text{m}$ to $\leq 20 \mu\text{m}$) is in a range that is common for these types of emulsion. This conclusion was also not in dispute between the parties. The Board therefore finds that the use of a blowing agent in emulsion in the polyol with a droplet size in the range as defined in operative claim 1 is an obvious measure for the skilled person looking for a further method and does not provide an inventive step over D1.

1.9 As to the use of a polyol of the specific type defined as A1c in operative claim 1, this polyol is not only disclosed in D4 (Example 22, Stepanpol [™] PS3152) and D5 (Example D, Stepanpol [™] PS-2002) but the general class of polyester polyether polyols to which it belongs is also disclosed as a possible polyol component of D1 in column 4, lines 15-22 (wherein the polyester polyols used can optionally be reacted with an alkylene oxide). In view of this, the use of a polyol A1c known in the art for the preparation of polyurethanes and also compatible with the teaching of D1 (in particular with the formation of an emulsion with a blowing agent) is also an obvious measure for the skilled person looking for a further method and cannot be seen as involving an inventive step.

1.10 The respondent contested this conclusion and based their disagreement in particular on the disclosure of D4. They argued that D4 would teach away from using a polyester polyether polyol because the method disclosed on pages 40 and 41 and in particular in example 22 of D4 showed that when a polyester polyether polyol of the

type Alc according to operative claim 1 was used in the preparation, the emulsion of blowing agents was not stable (Table 2, example 2, blowing agent separation at 24h disclosed as "little").

- 1.11 D4 relates to hybrid polyester-polyether polyols and their use in the production of polyurethane foams (see page 2, first and second full paragraphs). Specifically, Example 7 of D4 describes a hybrid polyester polyether polyol having a hydroxyl number of 205 mg KOH/g and obtained by the addition of propylene oxide to the esterification product of a phthalic anhydride and diethylene glycol (i.e. a polyol of type Alc according to operative claim 1). D4 describes the use of these polyester polyether polyols as co-polyols. Example 22 of D4 further exemplifies the use of the hybrid polyester polyether polyol of Example 7 as a co-polyol with one of the polyether polyols used in D1 (Voranol RN 482) in the production of a polyurethane foam.
- 1.12 D4 generally teaches that using such polyester polyether polyols is advantageous (more convenient and more economical, page 1, third paragraph). The results shown in Table 2 for the relevant composition of Example 22 (page 41) also points at improvements in the produced polyurethane resulting from the use of the polyester polyether polyol (page 40, last paragraph). That last passage on page 40 in particular points to the improved hydrocarbon compatibility and Table 2 shows that the blowing agent (cylcopentane) separation at 24h for the composition according to Example 22 (classified as "little") is better than in the case of the comparative example (indicated as "complete"). Such an indication can clearly be seen as advantageous and

not as teaching away from their use.

- 1.13 The respondent further considered that the composition according to Example 22 of D4 would not be favoured by the skilled person in view of the comparison of its demolding and Lamba properties disclosed in Table 2 on page 41 with those of the composition of Example 4 of D1 disclosed in Table 4, column 16 of that document.
- 1.14 The Board, however, does not find that a direct comparison of properties obtained from two different documents for compositions that differ in many ways from one another (among others differences in some of the polyols and the polyisocyanate and their amounts in Example 22 of D4 and example 4 of D1) can be seen as meaningful. As differences in the properties may be related to any of the differences in the compositions or to their combination, no conclusion can be based thereon on whether a specific component (here the polyester polyether polyol) is advantageous or not.
- 1.15 Therefore the arguments of the respondent do not provide any reason to invalidate the conclusion reached in paragraph 1.9 above that it would have been obvious for the skilled person to consider the use of polyester polyether polyols of the type A1c in the polyol mixture of the composition used in Example 4 of D1 in order to solve the posed problem.
- 1.16 Since both distinguishing features i) emulsion of the blowing agent in the polyol mixture and ii) use of a polyester polyether polyol Alcare are obvious for the skilled person looking for a solution of the posed problem and no interaction has been shown or claimed between the two of them, the Board comes to the conclusion that operative claim 1 lacks an inventive

step over D1.

Auxiliary requests 14 and 15

2. Admittance

2.1 Claim 1 of auxiliary requests 14 is identical to claim 1 of auxiliary request 15 and corresponds to granted claim 1 further modified in that in the component Alc "the epoxide is used in such an amount that the content of oxyethylene groups is 5 mass-% to 50 mass-% with respect to the total mass of polyol Alc".

2.2 Auxiliary requests 14 and 15 were filed for the first time in the appeal proceedings. These requests constitute an amendment to the respondent's case whose admittance into the proceedings is subject to the Board's discretion (Article 12(4) RPBA).

2.3 The respondent argued that auxiliary requests 14 and 15 were submitted in reaction to a fresh objection of the appellant in appeal according to which a polyester polyether polyol fulfilling the definition of Alc in operative claim 1 could be prepared by reaction with a very small amount of ethylene oxide and would be effectively the same as the commercially available product Stepanpol PS2352 used in the method of comparative example 4 of D17 (statement of grounds of appeal, page 9, seventh full paragraph).

2.4 Indeed, that specific objection was neither raised in the written opposition proceedings nor was it addressed in the decision under appeal. The appellant's argument that the respondent has reasons to file these requests in opposition, for instance together with document D17, cannot therefore be followed. To the contrary, the

filing of auxiliary requests 14 and 15 constitutes a reasonable and legitimate reaction to the new issue raised by the appellant for the first time in appeal. Under these circumstances, the Board finds it appropriate to make use of its discretion under Article 12(4) RPBA by admitting auxiliary requests 14 and 15 into the appeal proceedings.

3. Inventive step

3.1 The respondent argued that claim 1 of auxiliary requests 14 and 15 involved an inventive step starting from Example 4 of D1 if the teaching of the combination documents D4 and D5 was not found to be relevant. This was due to the fact that D1 did not teach polyester polyether polyols with a specific content of oxyethylene groups of 5 mass-% to 50 mass-% with respect to the total mass of polyol Alc. It is, however, apparent from the argumentation of the respondent (rejoinder, page 15, point 2) and at the oral proceedings before the Board that the limitation performed in claim 1 of auxiliary requests 14 and 15 further defined the second distinguishing feature, but was not associated with any particular effect. In this respect, the problem solved in view of Example 4 of D1 taken as the closest prior art remained, as for the main request, the provision of a further method for the production of polyurethane foams under reduced pressure.

3.2 D1 does not teach a specific content of oxyethylene groups. At the same time, the generic teaching of oxyalkylation of polyester polyols to give polyester polyether polyols in D1 (column 4, lines 20 to 22) does not further limit their structure, nor the oxyethylene content, so as to include the specific polyols taught

in D4 and D5 (see points 1.9 to 1.15, above) which were acknowledged by the respondent to fall under the definition of the polyol A1c in claim 1 of auxiliary requests 14 and 15.

3.3 The Board therefore based on the same reasons as outlined for the main request comes to the conclusion that the skilled person starting from D1 as the closest prior art would have considered the use of polyester polyether polyols disclosed in D4 (Example 22) and D5 (Example D) to be an obvious solution of the problem posed. Claim 1 of auxiliary requests 14 and 15 lacks therefore an inventive step over Example 4 of D1 as the closest prior art.

Order

For these reasons it is decided that:

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

The Registrar:

The Chairman:



D. Hampe

D. Semino

Decision electronically authenticated