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Datasheet for the decision of 23 January 2007

Case Number: T 0667/04 - 3.3.09

Application Number: 00906187.0

Publication Number: 1165674

IPC: C08J 9/32

Language of the proceedings: EN

Title of invention:
Foamed thermoplastic polyurethanes

Patentee:
HUNTSMAN INTERNATIONAL LLC

Opponents:
BASF Aktiengesellschaft, Ludwigshafen
CLARIANT INTERNATIONAL LTD.

Headword:
-

Relevant legal provisions:
EPC Art. 56, 114(2)
EPC R. 57a
RPBA Art. 10(b)

Keyword:
"Late filed documents (inadmissible)"
"Subsidiary request 3 (inadmissible)"
"Inventive step (no)"

Decisions cited:
T 0831/92, T 0252/92

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0667/04 **-** 3.3.09

D E C I S I O N
of the Technical Board of Appeal 3.3.09
of 23 January 2007

Appellant: (Patent Proprietor)
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Representative:
-

Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 16 April 2004 revoking European patent No. 1165674 pursuant to Article 102(1) EPC.

Composition of the Board:

Chairman: P. Kitzmantel
Members: N. Perakis
W. Sekretaruk

Summary of Facts and Submissions

I. Mention of the grant of European patent No. 1 165 674 in respect of European patent application No. 00906187.0 in the name of HUNTSMAN INTERNATIONAL LLC, which had been filed on 5 January 2000 claiming an EP priority of 26 January 1999 (EP 99101359), was announced on 7 August 2002 (Bulletin 2002/32). The patent, entitled "Foamed thermoplastic polyurethanes", was granted with twenty one claims. Independent process Claim 1 and independent product Claims 19 and 21 read as follows:

"1. Process for the preparation of foamed thermoplastic polyurethanes characterised in that the foaming of the thermoplastic polyurethane is carried out in the presence of thermally expandable microspheres and in the presence of an additional blowing agent, said microspheres containing a hydrocarbon."

"19. Foamed thermoplastic polyurethane obtainable by reacting a difunctional isocyanate composition with at least one difunctional polyhydroxy compound, in the presence of thermally expandable microspheres containing hydrocarbon, and in the presence of an additional blowing agent, said polyurethane having a density of not more than 700 kg/m^3."

"21. Reaction system comprising TPU and thermally expandable microspheres containing a hydrocarbon, said reaction system comprising an additional blowing agent."

Claims 2 to 18 were dependent, directly or indirectly, on Claim 1. Claim 20 was directly dependent on Claim 19.

II. A first Notice of Opposition was filed against the patent by BASF AG on 16 April 2003. Opponent I requested the revocation of the patent in its full scope, relying on Article 100(a) EPC (lack of novelty of Claims 1, 19 and 21 and lack of inventive step of all Claims).

III. A second Notice of Opposition was filed against the patent by Clariant International Ltd on 6 May 2003. Opponent II requested the revocation of the patent in its full scope, relying on Article 100(a) EPC (lack of novelty of Claim 1 and lack of inventive step of all Claims).

The opposition was *inter alia* supported by the following documents:

D1 : EP-A-0 692 516

D2 : Article "Mikrohohlkugeln aus Kunststoff", Kunststoffe, 82, 1992 (4), p. 300

D3 : J Petersen, "Expandable Microspheres", Surface Coatings Australia, October 1986, presented at the 28th OCCAA Convention, McLaren Vale, South Australia, by G. Woodley in July 1986, pp. 10-15

D4 : Brochure "EXPANCEL® IN UNDERBODY COATINGS, SEALANTS AND ADHESIVES", Akzo Nobel/Expancel, Sundsvall/SE October 1998

D5: Product information EXPANCEL DU, 16 December 1985 and product information EXPANCEL DU, 1 June 1994, Expancel, Sundsvall/SE

D6 : English translation of the Japanese Application, Laid Open Patent Application Number H10-152575.

IV. By its decision issued in writing on 16 April 2004 the Opposition Division revoked the patent.

V. The Opposition Division held in the appealed decision that the subject—matter of the granted Claims 1 to 21, though novel over D1 and D6, did not involve an inventive step over the combination of D1, considered as the closest state of the art, with D2.

According to this decision, D1 did not disclose the type of gas enclosed in the expandable microspheres and D6 did not disclose the use of an additional blowing agent in combination with the microspheres.

D1 was considered to relate to the same technical problem, ie the provision of a TPU foam having low density, short demould times and improved skin quality. While D1 did not disclose the type of gas contained in the expandable microspheres, it was obvious to the skilled person to select the EXPANCEL® expandable microspheres comprising isopentane disclosed in D2, which had the same polyacrylonitrile shell polymer and were used at the same foaming temperature of 130°C.

VI. On 17 May 2004 the Patent Proprietor (Appellant) lodged an appeal against the decision of the Opposition Division and paid the appeal fee on the same day.

With the Statement setting out the Grounds of Appeal filed on 16 July 2004, the Appellant argued that D6 militated against the conjoint use of the EXPANCEL® microspheres of D2 and of azodicarbonamide as blowing agents for the foaming of TPU as exemplified in D1 with respect to EVA compositions. The reason was that D6, which disclosed the use of azodicarbonamide as blowing agent for TPU, led to a poor surface and an irregular cell structure of the resulting PU foam. In support of its argument the Appellant submitted results of a repetition of the example of D1 using TPU instead of EVA and using EXPANCEL® microspheres, which led to foamed material with unsatisfactory properties.

It further submitted auxiliary request 1 comprising amended Claims 1 to 14 and a revised description.

VII. With a letter dated 19 November 2004, Respondent I (Opponent I) contested the inventivity of the subject-matter of the main request. It considered D1 as the closest state of the art and argued that the skilled person seeking to improve the preparation method of TPU foams using expandable microspheres would necessarily turn to the commercially available EXPANCEL® expandable microspheres filled with hydrocarbon such as those disclosed in D2 to D6.

Furthermore, it contested the patentability of the subject-matter of auxiliary request 1 on the grounds of insufficiency of disclosure, of lack of novelty and lack of inventive step.

VIII. With a letter dated 7 January 2005, Respondent II (Opponent II) concurred with the decision of the Opposition Division.

IX. With a letter dated 6 January 2005, the Appellant contested the argument of Respondent I, namely that the only expandable microspheres known in the art to comprise a hydrocarbon were the commercially available EXPANCEL® products.

In that respect it filed document D8: US 2797201.

It further submitted auxiliary request 2 comprising fourteen claims and a revised description.

X. With a letter dated 23 January 2006 the Appellant submitted six subsidiary requests replacing the previously filed auxiliary requests. Subsidiary requests 2 and 3 were subsequently replaced at the oral proceedings held before the Board.

Subsidiary request 1 comprised eighteen process claims corresponding to granted Claims 1 to 18. Subsidiary requests 4 to 6 were derived from the granted process claims, the subject-matter of Claim 1 corresponding to the subject-matter of granted Claim 1 further comprising features of the granted dependent claims.

Claim 1 of subsidiary request 4 comprised the following additional features:
"wherein the amount of microspheres is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane and wherein the amount of

blowing agent is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane".

Claim 1 of subsidiary request 5 comprised the following additional features:
"wherein the amount of microspheres is between 1.0 and 3.0 parts by weight per 100 parts by weight of thermoplastic polyurethane and wherein the amount of blowing agent is between 1.0 and 3.0 parts by weight per 100 parts by weight of thermoplastic polyurethane".

Claim 1 of subsidiary request 6 comprised the following additional features:
"wherein the amount of microspheres is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane and wherein the amount of blowing agent is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane, and wherein the starting thermoplastic polyurethane is made by using a difunctional isocyanate composition comprising an aromatic difunctional isocyanate".

XI. With a letter dated 15 December 2006 Respondent II contested the inventivity of the subject-matter of the subsidiary requests, which comprised the additional feature of the blowing agent content. It argued that it was part of the general technical knowledge of the person skilled in the art that, the more blowing agent was used, the more foaming occurred, in support of which it filed D7 (an extract from the text book "Thermoplastische Strukturschaumstoffe" of 1980, pages 3, 16-19). It concluded that the optimisation of the amount of the blowing agent in order to achieve a

specific density was within the competence of the skilled worker.

XII. On 23 January 2007 oral proceedings were held before the Board.

At these proceedings the Appellant submitted new subsidiary requests 2 and 3, replacing those on file. Claim 1 of each of these requests corresponded to granted Claim 1 combined with additional features from granted dependent claims.

Claim 1 of subsidiary request 2 comprised the following additional feature:
"where the amount of blowing agent is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane".

Claim 1 of subsidiary request 3 comprised the following additional feature:
"wherein an endothermic blowing agent is present".

XIII. The arguments put forward by the Appellant in its written submissions and at the oral proceedings can be summarized as follows:

- The subject-matter of Claim 1 of the main request and subsidiary request 1 involved an inventive step over the cited prior art.

- D1, in view of Claim 3's dependency on Claim 1, but not on Claims 1 or 2, did not disclose the foaming of TPU with a combination of a chemical blowing agent and expandable microspheres.

– D1 disclosed a foaming process using pre-expanded - not expandable - microspheres.

– In view thereof it was not obvious to combine its disclosure with that of D2, which referred to expandable microspheres.

– Similarly, the combination of D1 with D3, also disclosing pre-expanded microspheres, did not lead to the claimed invention.

– The combined use of a blowing agent and expandable microspheres comprising a hydrocarbon was not disclosed in any of D1-D6, let alone for use in making foamed TPU.

– D6 (comparative example) constituted a technical prejudice against the use of a blowing agent like azodicarbonamide in TPU because of the unsatisfactory results of cell size structure and surface appearance evidenced therein.

– In order to decide on the filling of the microspheres of D1 the person skilled in the art would not have limited himself to some marketed microspheres, such as those of D2, but would also have considered other known microspheres, such as those disclosed in D7, which were filled with over 30 substances other than hydrocarbons.

– Furthermore, the subject-matter of Claim 1 of subsidiary request 2 was not obvious over the combination of D1 and D2, because the skilled person aiming at improving the properties of the foamed TPU of D1, obtained following the process exemplified therein, and considering the teaching of D6 and D7, would not be motivated to reduce the amount of the azodicarbonamide blowing agent to the claimed range.

– The subsidiary request 3 should be allowed into the proceedings as the subject-matter of Claim 1 resulted from the restriction of granted independent Claim 1 by the additional feature of granted dependent Claim 5, which was not contested in the appealed decision. The late filing of this request, though due to an oversight of the representative, did not occur at too advanced a stage of the oral proceedings before the Board.

– The subject-matter of Claim 1 of subsidiary requests 4 and 5 involved an inventive step over D1 in view of the combination of the specified amount of blowing agent with the specified amount of microspheres. This combination, in view of the experimental evidence filed on 11 December 2003, led to an unforeseeable synergistic effect with regard to abrasion loss, demould time and density of the thermoplastic foam.

– The prior art contained no hint to modify the amounts of blowing agent and microspheres. There was no suggestion to reduce these amounts to less than 10 pbw, which were the amounts exemplified by D1 and also the amounts used by the proprietor when

repeating example 1 of D1, the latter leading to unsatisfactory foam properties. D6 (Table 2) and the above experimental evidence submitted with letter dated 11 December 2003 showed that the use of azodicarbonamide alone at an amount within the claimed range provided unsatisfactory foam.

– The subject-matter of Claim 1 of subsidiary request 6 involved an inventive step over D1 in view of the feature related to the starting thermoplastic polyurethane. This feature resulted from a non-obvious multiple selection over D1.

XIV. The Respondents essentially argued as follows:

– The subject-matter of Claim 1 of the main request and subsidiary request 1 did not involve an inventive step over the combination of D1 with D2.

– When considering the disclosure of D1, account should be taken of its whole content and not only of the claims and their interdependence. It was therefore not correct to conclude that D1 did not disclose TPU in combination with expandable microspheres and an additional blowing agent.

– The skilled person reading D1 would have understood that the microspheres disclosed therein were expandable and not pre-expanded. The foaming conditions of D1, namely the minimum temperature of 130°C and the minimum time of 2 minutes, were sufficient for their expansion. The subsequent cooling down to 2°C from 130°C was nothing more than

a normal step in the process of foam injection moulding.

– D1 should be considered as the closest state of the art, since it disclosed thermoplastic polyurethanes manufactured by using the combination of expandable microspheres with chemical blowing agents.

– D6 was not the closest state of the art, since it did not disclose the combination of a chemical blowing agent with expandable microspheres.

– The claimed subject-matter was admitted to be novel over D1, which did not disclose the nature of the filling of the microspheres though it mentioned that commercial products were used.

– The foams of the claimed invention had the same properties as those of D1. The problem to be solved thus consisted in finding another foam manufacturing process.

– The skilled person looking for commercial products able to be used as expandable microspheres in D1 would have found the solution in D2, which concerned commercial expandable microspheres filled with hydrocarbons, and would therefore have no hesitation in thinking that the expandable microspheres of D2 would be suitable for the TPU foaming process of D1.

– The patent in suit did not contain any indication of an advantageous effect relying on the only distinguishing feature, ie the gas filling of the microspheres, when compared with other possibly

expandable microspheres as the comparative examples of the patent in suit did not correspond to the closest state of the art D1.

– The subject-matter of Claim 1 of subsidiary request 2 also lacked an inventive step over the combination of D1 with D2. The additional technical feature of the amount of the blowing agent resulted from routine optimisation when seeking to modify the foam density not involving inventive effort.

– It was general technical knowledge that the appropriate density of the foam was dependent on its intended use and that the density was influenced by the amount of the blowing agent.

– Whereas the more blowing agent was used the lower the resulting foam density, there was a critical limit to the amount of blowing agent, which, depending on the foamed plastic and the process conditions, corresponded to the minimum density, and which could not be further reduced no matter how great the amount of blowing agent.

– The skilled person who considered the properties of the foam of the repeat example of D1 using TPU and 10 pbw of azodicarbonamide blowing agent unsatisfactory would have concluded that the deficiencies encountered were related to the low density of only 200 Kg/m^3, a drawback that could be easily redressed by reducing the amount of blowing agent. The claimed range of the amount of the blowing agent thus lay within the competence of the skilled person.

– Subsidiary request 3 should not be admitted as it was late filed.

– The subject-matter of Claim 1 of subsidiary requests 4 and 5 lacked an inventive step, since the combination of blowing agent and microspheres was disclosed in D1 and since no technical effect, such as a synergy, could be acknowledged for the combination of the specified amounts of each of them. These amounts were obtained by routine optimisation.

– The experimental evidence filed on 11 December 2003 was irrelevant in this respect, since it did not compare the claimed process with that of the closest state of the art D1.

– Even if that experimental evidence was considered, it merely showed that the values for the abrasion loss and the demould time, obtained from the combination of blowing agent and microspheres, fell in the middle of the range formed by the values obtained from the single use of these components.

– The technical information contained in Table 2 of D6 would not have been considered by the skilled person, since it was not related to a comparison with the closest state of the art.

– The subject-matter of Claim 1 of subsidiary request 6 lacked an inventive step over the combination of D1 with D2, since the additional feature

characterising the thermoplastic polyurethane lacked novelty over D1.

– The thermoplastic TPUs disclosed in D1 could only be derived from aliphatic or aromatic polyisocyanates; the choice of one member from a list of two could not, however, be considered as a selection. This was in particular so, when the skilled person was aware that aromatic TPUs represented about 90% of TPU manufactured worldwide.

XV. The Appellant requested that the decision under appeal be set aside and that the oppositions be rejected or, alternatively, that the decision under appeal be set aside and the European patent be maintained on the basis of subsidiary request 1, filed with letter dated 23 January 2006, or on the basis of subsidiary request 2, dated 23 January 2007, or on the basis of subsidiary request 3, dated 23 January 2007, or on the basis of one of the subsidiary requests 4 to 6, filed with letter dated 23 January 2006.

XVI. The Respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Procedural matters*

2.1 Admissibility of documents D7 and D8

These late filed documents, though submitted in reply to the arguments raised by the opposing party, were not considered relevant for the claimed subject-matter and were not admitted into the proceedings (Article 114(2) EPC).

D7 discloses general technical knowledge of the person skilled in the art with regard to the relation between the density of thermoplastic foamed structures and the amount of blowing agent used for the foaming operation. As this general technical knowledge was not disputed by the parties, there is no need to admit this document into the proceedings.

D8 discloses hollow spherical particles with a thin, strong skin and a gas sealed therein, which is selected from a list of organic and inorganic gases and which exerts pressure so as to resist shrinkage of the particle walls. D8 does not add any relevant information to the disclosure of D2, and is therefore not more relevant than that document for the claimed subject-matter.

2.2 Admissibility of subsidiary requests 1 to 6

All subsidiary requests were filed after the submission of the statement of the Grounds of the appeal. Subsidiary requests 1 and 4 to 6 were filed with letter dated 23 January 2006 and subsidiary requests 2 and 3 at the oral proceedings held before the Board on 23 January 2007.

The Board decided under Article 10(b) RPBA and Rule 57a EPC to admit subsidiary requests 1, 2 and 4 to 6 but not to admit subsidiary request 3. All subsidiary requests fulfil the requirement of Rule 57a as they are occasioned by the grounds of opposition. Subsidiary requests 1, 4 to 6 were filed one year before the oral proceedings and subsidiary request 2 was based directly on previous subsidiary request 2, also filed one year before the oral proceedings, by suppression of claims. Since these requests were filed sufficiently in advance of the oral proceedings in an attempt to overcome the lack of inventive step objection of the appealed decision, there was sufficient time to the Respondents to prepare their cases. The submission of these requests is therefore in agreement with the principle of procedural fairness. The Board exercising its discretionary power thus admitted these requests.

This does not apply to subsidiary request 3, whose independent Claim 1 relates to a new aspect, ie the chemical nature of the blowing agent, deviating from the subject-matter of Claim 1 of the other subsidiary requests and whose filing for the first time at the oral proceedings before the Board took the parties by surprise at this very late stage of the procedure.

Admitting this request could have led to a postponement of the oral proceedings and thus unacceptably delayed the conclusion of the appeal procedure. Since no exceptional circumstances were put forward excusing the late filing of this request, to have admitted it would have run counter to the principle of procedural fairness (see eg T 831/92, Reasons 3, not published in the OJ EPO).

The Board does not concur with the Appellant who argued that the present case was procedurally comparable with that of T 252/92 (cf. Reasons 3; not published in the OJ EPO), in which the filing of a new main request at the beginning of the oral proceedings was admitted by the Board. In the present case, not only did the Appellant begin the oral proceedings with seven requests but also amended the second subsidiary request during the proceedings, which was duly considered by the Board. Moreover, the feature thereby introduced shifted the technical focus to a completely new issue which was never before under discussion. Consequently, from a factual point of view the admissibility of the new third subsidiary request, which would take its place among seven other requests, cannot be compared to that of the sole new main request which was admitted according to the decision mentioned above, and no parallel with the present case can be drawn.

Moreover, the alleged excuse, that subsidiary request 3 was not filed together with the other requests on 23 January 2006 because of the representative's oversight, even if considered, would not justify the very late filing of this request, whose admission as

set out above was counter to the principle of procedural fairness.

3. Novelty (Article 54 EPC)

The novelty of the main request was acknowledged in the appealed decision. The Respondents, who had raised this objection before the opposition division, did not maintain it before the Board. The Board is satisfied that the main request and all admissible subsidiary requests, whose subject-matters are a restriction of the subject-matter of the main request, meet the novelty requirement.

4. *Inventive step (Article 56 EPC)*

4.1 The closest state of the art

D1 (column 1, line 44 to column 2, line 4; column 2, lines 21 to 35; claim 3) represents the closest state of the art for all requests. On the one hand D1 discloses a process for the preparation of foamed and moulded thermoplastic polymers, thermoplastic polyurethanes (TPUs) inclusive, in which the foaming operation is carried out in the presence of a dual foaming system consisting of expandable microspheres and an additional blowing agent and on the other hand it addresses the technical objectives mentioned in the patent in suit (paragraphs [0008] and [0009]), namely the manufacture of TPU foams having low density and improved skin quality which can be produced at reduced demould times.

With regard to the nature of the microspheres used according to D1, the Board does not agree with the Appellant, who argued that D1 discloses pre-expanded, as opposed to expandable, microspheres. In this respect it is to be noted that according to the process of D1 (column 1, lines 51 to 57; column 2, lines 3 to 5 and 40 to 53) the foaming involves "microballoons", which is a term equivalent to the term "microspheres" used in the patent in suit, which microballoons are filled with a gas and are able to expand upon heating at a foaming temperature of around 130°C. This is consistent with the wording of claim 2, which concerns foam formulations containing a foam concentrate, which expands and forms microballoons, and that of claim 5, which specifies that the foam concentrate is not used in a pre-expanded form but forms microspheres at 130°C.

The Board does not accept the argument of the Appellant that the microballoons do not expand at the process conditions of D1 because of the very short foaming time of 2 minutes at 130°C, and the immediate cooling down to 2°C. Firstly, the Board would point out that D1, column 3, lines 24 to 26, discloses that 2 minutes is the minimum foaming time and 130°C is the minimum foaming temperature and secondly no technical reasons were put forward to persuade the Board that even at the minimum foaming time and temperature the expansion of the microballoons would not occur. With regard to the cooling down of the foam to 2°C, this is a necessary step in a production-related injection moulding process in order to achieve a reasonable output, this technique being the preferred production method of the claimed invention (specification, paragraph [0051]).

Finally the Board notes that the teaching of D1 is not confined to the content of the claims or the detailed information given in the example but that it embraces any enabling information in its specification. Therefore, contrary to the assertions of the Appellant, D1 is considered to disclose not only the exemplified foaming of a thermoplastic EVA copolymer using the combination of expandable microspheres with an additional blowing agent but also the foaming of thermoplastic polyurethanes with the same combination of blowing agents (column 1, line 25 and lines 44-54; claim 3).

As far as D6 is concerned (abstract; paragraph [0009]; example 1), the Board does not consider that this document represents a closer starting point for the assessment of inventive step. Even though D6 relates to a process for the preparation of foamed and moulded thermoplastic polyurethanes (TPU) with a "beautiful surface" at a target density, this foaming process is carried out exclusively in the presence of expandable microspheres, in the absence of an additional blowing agent, and thus the disclosure of D6 is more remote from the claimed subject-matter than the disclosure of D1.

4.2 The main request (granted Claims)

The subject-matter of Claim 1 of the main request is distinguished from the process of D1 in that the gaseous content of the microspheres is specified to be a hydrocarbon (which becomes a gas at the temperature of the foaming conditions used).

The patent in suit does not contain any technical information, nor has the Appellant ever filed any evidence related to the impact on the claimed process of the nature of the filling of the microspheres. The contested patent (paragraphs [0008] to [0010]) aims at a process for manufacturing foams with low density, improved skin quality at reduced demould times.

The process of D1 (column 2, lines 27 to 35), which does not disclose the nature of the filling of the expandable microspheres, also aims at the manufacture of foams with low density, high imaging precision and produced in relatively short production cycles.

Consequently, the technical problem to be solved in the light of D1 is to put into practice the process of D1 by finding a filling to be used which makes the microspheres expand at the applied foaming temperature.

The solution of this problem by using a hydrocarbon is obvious to the person skilled in the art, who appreciates the information in D1 to use commercially available microspheres (column 1, lines 54 to 57) and is thus taught to explore the feasibility of products on the market. D2 describes one of these products having not only a shell polymer based on acrylonitrile, the material of the microballoons exemplified in D1, but which is also expandable at the same foaming temperature of 130°C as indicated for the microballoons of D1 (a property related to the use of the isopentane filling, a hydrocarbon, gaseous at this expansion temperature). The skilled person is thus directly led to the claimed subject-matter without involving any inventive effort.

The Board does not consider that the disclosure of microspheres with a filling other than a hydrocarbon would prevent the skilled person from using the microspheres of D2 in the foaming process of D1. Even if other filling materials could theoretically be considered, the above technical information in D2, which even points at the possibility of using EXPANCEL® microspheres in the extrusion of thermoplastics, is a direct pointer at their suitability in the dual foaming process of D1.

Consequently the subject-matter of Claim 1 of the main request lacks an inventive step (Article 56 EPC) and this request is not allowable.

4.3 Subsidiary request 1

The subject-matter of Claim 1 of this request is the same as the subject-matter of Claim 1 of the main request. Therefore the reasoning on inventive step for the subject-matter of Claim 1 of the main request applies *mutatis mutandis* to the subject-matter of Claim 1 of subsidiary request 1, which is thus likewise considered to lack an inventive step (Article 56 EPC).

This request is therefore not allowable.

4.4 Subsidiary request 2

Compared to the subject-matter of Claim 1 of the main request the subject-matter of Claim 1 of subsidiary request 2 further comprises the feature of the amount

of the additional blowing agent used in the foaming process of the TPU.

The subject-matter of Claim 1 of this request is thus distinguished from the process of D1 in that:

- the gas of the expandable microspheres is a hydrocarbon, and

- the amount of the additional blowing agent is between 0.5 and 4.0 parts by weight (pbw) per 100 parts by weight (pbw) of thermoplastic polyurethane.

With regard to the gas filling of the expandable microspheres and its impact on the inventive step of the claimed process, this has been discussed above (see section 4.2). The Board notes that neither the patent in suit nor the state of the art establishes any technical relationship between the hydrocarbon content of the expandable microspheres and the amount of the blowing agent, so that the contribution of each of these features to the claimed invention is to be considered independently.

With regard to the claimed amount of additional blowing agent, the patent in suit does not provide any basis for its contribution to the solution of the technical problem cited in paragraphs [0008] to [0010], ie to find a process for the manufacture of TPU foams with low density, improved skin quality at reduced demould times. Only on the basis of the additional experimental evidence, filed with the Statement of Grounds of Appeal, has the Appellant shown that the claimed range of amounts of 0.5 to 4 pbw contributes to the solution of

the above mentioned technical problem, because this evidence appears to show that this range is relevant for the desired foam properties. In fact, the Appellant has shown by means of additional experimental evidence that the skilled person carrying out the foaming of TPU following the preferred embodiment of D1, the example, does not get a foam with satisfactory properties. More precisely, by using 10 pbw of additional blowing agent the manufactured foam though having a very low density, of about 200 Kg/m^3, exhibits a poor cell structure, a very thin skin, poor strength, unstable processing and extremely bad abrasion resistance.

Therefore the skilled person, starting from D1 and aiming at obtaining foams which combine reduced density and improved skin quality at reduced demould times, would realise that the foaming conditions have to be modified in order to provide an acceptable combination of foam properties. In the absence of any precise information in the available state of the art, the way in which the skilled person would undertake such modification(s) essentially depends on his general technical knowledge in the specific technical field of TPU foaming. The Board acknowledges that the skilled person is aware that one parameter that greatly influences the mechanical properties of the foam is the density of the foam, which is in turn dependent on the amount of blowing agent used. It is apparent, that, at higher foam densities than those obtained according to the Appellant's repeat example with TPU (about 200 Kg/m^3) and certainly at the higher foam densities to be used according to the claimed invention (specification page 5, lines 21 and 24: less than 800 Kg/cm^3 down to 350 Kg/m^3), the mechanical properties will be enhanced.

On the basis of his general common knowledge the skilled person will therefore, without any doubt, be able to improve the mechanical properties of the foam by an increase of the foam density, ie by reducing the quantity of foaming agent. In the present case this involves *inter alia* the use of less "additional" blowing agent (eg azodicarbonamide).

The Board does not concur with the Appellant's argument that the reduction of the amount of the additional blowing agent was not obvious, on the ground that the expert would not expect that such a reduction would lead to any modification of the density, because the claimed range lay within that part of the "foam density"/"blowing agent amount" relationship curve, where a change of the amount of blowing agent would have no influence on the density. This argument is not convincing, not only because it is not accompanied by technical evidence, and is thus a mere assertion, but also because it is contradicted by a comparison of the experimental evidence of the patent with that filed with the Statement of Grounds of Appeal. This evidence shows that larger amount of 10 pbw azodicarbonamide blowing agent leads indeed to lower foam densities.

Furthermore, the Board does not agree with the Appellant, who has argued that D6 (Table 2, comparative example) established a technical prejudice against the use of the additional blowing agent (azodicarbonamide) at the amount of 1.5 pbw, which, although lying within the claimed range, provided a TPU foam whose surface appearance and cell structure were not good. In the Board's judgment, this argument of the Appellant is inconclusive because the foaming of this comparative

example was carried out in the absence of expandable microspheres, which are known from D1 (column 2, lines 27 to 35) to exert an important influence on the foaming process and on the resulting foams when used together with the additional blowing agent. Thus the technical evidence of D6 is irrelevant for the issue of inventive step.

It follows from the above considerations that the skilled person starting from D1 and seeking to optimise the mechanical properties of TPU foams would, in an obvious way, consider a reduction of the amount of the additional blowing agent exemplified in D1 in connection with the manufacture of EVA foams, thus arriving at TPU foams which still have a "low density" in the terms of the claimed invention. It goes without saying that enhancing the mechanical properties causes higher stability against demoulding defects leading to a lowering of the demould times.

As to the further desired property of good skin quality, there is no evidence on file which would allow the conclusion that there is any improvement over the TPU foams prepared in accordance with the teaching of D1. As set out above, the information to be gained from D6 is not appropriate to evaluate the influence of different foam densities on TPU foams manufactured in the presence of expandable microspheres and additional blowing agent. Moreover, skin quality of injection moulded foam articles is dependent on a variety of processing parameters whose specification is completely left open by the claimed subject-matter.

Consequently, the subject-matter of Claim 1 of subsidiary request 2 lacks an inventive step (Article 56 EPC) and this request is not allowable.

4.5 Subsidiary request 4

The subject-matter of Claim 1 of subsidiary request 4 is distinguished from the process of D1 in that:

- the gas of the expandable microspheres is a hydrocarbon,

- the amount of the additional blowing agent is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane, and

- the amount of microspheres is between 0.5 and 4.0 parts by weight of the thermoplastic polyurethane.

Compared to the subject-matter of Claim 1 of subsidiary request 2, the subject-matter of Claim 1 of this request further comprises the feature of the amount of microspheres used in the foaming process of TPUs.

As already discussed in respect of the amount of the additional blowing agent (see above section 4.4), the patent specification does not provide any basis for the technical contribution of the combination of the amount of the additional blowing agent with the amount of the expandable microspheres to the solution of the technical problem cited in paragraphs [0008] to [0010], ie to find a process for the manufacture of TPU foams with low density, improved skin quality at reduced demould times. Only on the basis of the additional

experimental evidence, filed with the Statement of Grounds of Appeal, has the Appellant shown that the claimed amount of 0.5 to 4.0 pbw of each of these foaming agents may contribute to the solution of some aspects of the above mentioned technical problem.

Therefore the skilled person, starting from D1 and aiming at obtaining foams which combine reduced density and improved skin quality at reduced demould times, would have to modify the foaming conditions in such a manner that the density remains reduced but the other properties are improved. Following the reasoning developed above (see section 4.4) the skilled person would have to proceed in accordance with his general common knowledge in the art. Taking that into account, the skilled person may choose to simultaneously modify the amounts of both foaming agents, namely the additional blowing agent and the extendable microspheres, because he is aware from D1 that these two blowing agents, when used conjointly, may act favourably on the foaming process and the foam properties. Knowing this, it would not amount to more than routine experimentation to optimise the amounts and relative proportions of the two types of blowing agents involved.

Consequently, the subject-matter of Claim 1 of subsidiary request 4 lacks an inventive step (Article 56 EPC).

The Appellant has argued that the comparative examples, submitted with letter dated 11 December 2003 (page 2, Table 1) before the Opposition Division, show a synergistic effect. This effect should result from the

comparison of the properties of TPU foams prepared, on the one hand, using the combination of an additional blowing agent and expandable microspheres at amounts falling within the claimed ranges and, on the other hand, using each of these foaming agents alone at an amount equal to the total amount of the combined foaming agents.

Contrary to the allegations of the Appellant, the Board does not see any synergistic effect. The reason for this is that the results concerning the abrasion loss and demould time of the combined foaming agents lie in the middle of the range defined by the results of each of these properties obtained by using each individual foaming agent alone. This situation implies a mere addition of the two effects and not an unexpected enhancement of the effect achieved by the use of a single foaming agent.

The Appellant also argued that the skilled person starting from D1 finds no incentive in the art which would lead him to the claimed amounts of the foaming agents - which are smaller than the amounts used in the additional experimental evidence submitted by the Appellant with the Statement of Grounds of Appeal - because there was a technical prejudice expressed in D6 (page 11, Table 2, comparative example) against the use of smaller amounts of the additional blowing agent (azodicarbonamide) such smaller amounts causing a poor surface appearance. The Board does not agree with this argument. The reason is that D6 discloses that the surface appearance of a foam manufactured using the second blowing agent of the foaming composition, ie the expandable microspheres, in equal amounts is good.

Therefore D6 rather suggests that it would be reasonable to expect that by combining the additional blowing agent with expandable microspheres a compensation of the unsatisfactory property would occur.

Since the subject-matter of Claim 1 of subsidiary request 4 lacks an inventive step, this request is not allowable.

4.6 Subsidiary request 5

The subject-matter of Claim 1 of subsidiary request 5 is distinguished from the process of D1 in that:

- the gas of the expandable microspheres is a hydrocarbon,

- the amount of additional blowing agent is between 1.0 and 3.0 parts by weight per 100 parts by weight of thermoplastic polyurethane, and

- the amount of microspheres is between 1.0 and 3.0 parts by weight of the thermoplastic polyurethane.

In comparison to the subject-matter of Claim 1 of subsidiary request 4, the subject-matter of this request relates to narrower value ranges for the amount of the additional blowing agent and the expandable microspheres used in the foaming process of TPUs.

For the reasons set out in relation to the broader value ranges (see above section 4.5), the narrower value ranges would also be obvious to the person

skilled in the art and the subject-matter of Claim 1 of subsidiary request 5 lacks an inventive step too.

Since the subject-matter of Claim 1 of subsidiary request 5 lacks an inventive step, this request is not allowable.

4.7 Subsidiary request 6

The subject-matter of Claim 1 of subsidiary request 6 is distinguished from the process of D1 in that:

- the gas of the expandable microspheres is a hydrocarbon,

- the amount of the additional blowing agent is between 0.5 and 4.0 parts by weight per 100 parts by weight of thermoplastic polyurethane,

- the amount of microspheres is between 0.5 and 4.0 parts by weight of the thermoplastic polyurethane, and

- the starting thermoplastic polyurethane is made by using a difunctional isocyanate comprising an aromatic difunctional isocyanate.

In comparison to the subject-matter of Claim 1 of subsidiary request 4, the subject-matter of Claim 1 of this request further comprises the feature of a more specific definition of the starting TPU.

While it might be argued that this subject-matter lacks novelty over the disclosure of D1,

– because the restriction to a "specific" TPU derived from aromatic diisocyanates amounts to a "selection" from a group of only two possibilities, the other possibility being aliphatic diisocyanates,

– because the term TPU as used in D1 encompasses both alternatives with the consequence that both are within its disclosure,

– and also taking into account that the vast majority of all marketed TPUs are derived from aromatic diisocyanates

it is evident that, even if considered novel, the structural TPU feature introduced into Claim 1 of this auxiliary request is not adequate to provide an inventive step.

There is no information available in the patent specification or otherwise submitted by the Appellant from which any impact of this structural feature on the objectives underlying the claimed invention can be inferred. With regard to the problem to be solved, this restriction is thus to be considered as an arbitrary one, unable to contribute to the alleged inventivity of the claimed subject-matter.

It follows that this auxiliary request, which does not satisfy the requirements of Article 56 EPC, is also not allowable.

4.8 In summary, none of the Appellant's requests is allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

G. Röhn P. Kitzmantel