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# Datasheet for the decision of 4 September 2018

**Case Number:** T 1926/15 - 3.3.03

**Application Number:** 05794788.9

**Publication Number:** 1797142

**IPC:** C08L77/06, F16L11/04

**Language of the proceedings:** EN

**Title of invention:**
FLEXIBLE SEMICRYSTALLINE POLYAMIDES

**Patent Proprietor:**
ARKEMA FRANCE

**Opponent:**
Evonik Degussa GmbH

**Relevant legal provisions:**
EPC Art. 54, 56
RPBA Art. 13(1), 13(3)

**Keyword:**
Novelty - Main request and auxiliary requests 1-4 and 7 (no)
Inventive step - Auxiliary requests 5 and 6 (no) - Auxiliary request 8 (yes)

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**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 1926/15 - 3.3.03**

# D E C I S I O N
# of Technical Board of Appeal 3.3.03
# of 4 September 2018

| | |
|---|---|
| **Appellant:** (Patent Proprietor) | ARKEMA FRANCE<br>420, rue d'Estienne d'Orves<br>92700 Colombes (FR) |
| **Representative:** | Crest, Véronique<br>Casalonga & Partners<br>European Patent and Trademark Attorneys<br>Bayerstrasse 71-73<br>80335 München (DE) |
| **Respondent:** (Opponent) | Evonik Degussa GmbH<br>Rellinghauser Straße 1- 11<br>45128 Essen (DE) |
| **Representative:** | f & e patent<br>Fleischer, Engels & Partner mbB, Patentanwälte<br>Braunsberger Feld 29<br>51429 Bergisch Gladbach (DE) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted on 28 July 2015 revoking European patent No. 1797142 pursuant to Article 101(3)(b) EPC.** |

**Composition of the Board:**

| | |
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| **Chairman** | D. Semino |
| **Members:** | D. Marquis |
| | C. Brandt |

## Summary of Facts and Submissions

I. The appeal lies with the decision of the opposition division posted on 28 July 2015 revoking European patent No. 1 797 142.

II. The European patent was granted on the basis of 18 claims, claim 1 reading as follows:

"1. Multilayer structure in which the inner layer is in contact with the petrol or diesel and comprising, in succession from the outside inwards:

an outer layer consisting of the composition comprising, by weight, the total being 100%:

50 to 100% of at least one polyamide A1 of formula X.Y/Z or 6.Y2/Z in which:
- X denotes the residues of an aliphatic diamine having from 6 to 10 carbon atoms,
- Y denotes the residues of an aliphatic dicarboxylic acid having from 10 to 14 carbon atoms,
- Y2 denotes the residues of an aliphatic dicarboxylic acid having from 15 to 20 carbon atoms and
- Z denotes at least one unit chosen from the residues of a lactam, the residues of an α,ω-aminocarboxylic acid, the unit X1. Y1 in which X1 denotes the residues of an aliphatic diamine and Y1 denotes the residues of an aliphatic dicarboxylic acid, the weight ratios Z/(X+Y+Z) and Z/(6+Y2+Z) being between 0 and 15%,

0 to 40% of a plasticizer;
0 to 50% of an impact modifier; and
0 to 50% of a polyamide A2,

- a PA-6 layer or a layer of a PA-6/polyolefin blend

having a PA-6 matrix,
- an EVOH layer,
- a PA-6 layer or a layer of a PA-6/polyolefin blend having a PA-6 matrix".

III. A notice of opposition was filed in which revocation of the patent in suit was requested.

IV. During opposition proceedings, the following documents *inter alia* were cited:

D2: EP 1 162 061
D3: GB 2 390 658
D6: EP 1 216 826
D8: Benoît Brulé, "Permeabilität von Polymerlegierungen", Kunststoffe, 2004, 4, pages 102 to 105

V. The decision of the opposition division to revoke the patent was announced at the oral proceedings on 29 June 2015. The decision was based on a main request and five auxiliary requests. The main request was filed on 27 April 2015 and corresponded to the claims as granted from which claim 5 was deleted. Auxiliary requests 1 to 3 were also filed with letter of 27 April 2015. In auxiliary request 1, the nature of the PA-6/polyolefin blend was limited to a specific composition. In auxiliary request 2, the nature of the polyamide A1 was restricted to limited polyamides. Auxiliary request 3 comprised the limitations of both auxiliary request 1 and auxiliary request 2. Auxiliary request 4 was filed during the oral proceedings before the opposition division. Claim 1 of that request corresponded to claim 1 as granted limited in that the layer located between the outer layer and the ethylene vinyl alcohol layer (EVOH) was a layer of a PA-6/

polyolefin blend having a PA-6 matrix and that such a blend was defined as "comprising, the total being 100%:
- 50 to 90% PA-6;
- 1 to 30% HDPE; and
- 5 to 30% of at least one polymer P1 chosen from impact modifiers and polyethylenes,
at least one of the HDPE and P1 being completely or partly functionalized".

Finally, auxiliary request 5 corresponded to auxiliary request 4 as filed with letter of 27 April 2015 that was limited to the device comprising a multilayer as defined in claim 1 of the main request.

The decision of the opposition division, as far as relevant to the present decision, can be summarised as follows:

(a) The amendment of "next" to "EVOH" (ethylene-vinyl alcohol) in the text of the description of the main request satisfied the requirements of Article 123(2) EPC since that amendment did not add any new teaching to the description.

(b) The subject matter claimed in the main request was sufficiently disclosed.

(c) The terms "PA-6 layer" and "PA-6/polyolefin blend having a PA-6 matrix" were interpreted so as to encompass any type of additional components. As a result, claims 1, 13 and 16 of the main request lacked novelty over D6. In particular example 1 of D6 disclosed a multilayer structure comprising an intermediate layer based on a mixture of PA-12, PA-6, a polyethyleneimine-PA-6 copolymer and an impact modifier being a functionalized polyolefin.

That layer was considered to be a "PA-6 layer" as well as a "PA-6/polyolefin blend having a PA-6 matrix", so that example 1 of D6 disclosed a multilayer structure which fell under claim 1 of the main request. The same conclusion applied to auxiliary requests 1 to 3 and 5.

(d) D6 was the closest prior art for the subject matter of claim 1 of auxiliary request 4. The problem solved was to provide a multilayer structure suitable for storage or transport of petrol or diesel and having a good adhesion between layers. D8 provided the solution to that problem which was the use of well known PA-6/functionalized polyolefins blends, so that the subject matter of claim 1 of auxiliary request 4 lacked an inventive step.

VI. The proprietor (appellant) lodged an appeal against that decision and submitted with the statement setting out the grounds of appeal a main request, corresponding to the main request filed on 27 April 2015, as well as auxiliary requests 1 to 9. The appellant also filed *inter alia* the test report D11.

VII. In its reply to the statement of grounds of appeal, the opponent (respondent) requested that the appeal be dismissed.

VIII. In a communication sent in preparation of oral proceedings, the Board summarised the points to be dealt with and provided a preliminary view on the disputed issues.

IX. In a letter dated 27 July 2018, the appellant replaced auxiliary request 1 filed with the statement setting

out the grounds of appeal with a new auxiliary request 1 corresponding to the claims of the main request with a new description page 5. A new auxiliary request 2 was also filed corresponding to the claims of the main request with a new description page 9. Auxiliary requests 2 to 9 filed with the statement setting out the grounds of appeal were renumbered as new auxiliary requests 3 to 10.

Claim 1 of auxiliary request 3 differed from claim 1 of the main request in that the layer located between the outer layer and the ethylene vinyl alcohol layer (EVOH) was a layer of a PA-6/polyolefin blend having a PA-6 matrix and that such a blend was defined as "comprising, the total being 100%:
- 50 to 90% PA-6;
- 1 to 30% HDPE; and
- 5 to 30% of at least one polymer P1 chosen from impact modifiers and polyethylenes,
at least one of the HDPE and P1 being completely or partly functionalized".

Claim 1 of auxiliary request 4 was based on claim 1 of the main request in which the polyamide A1 was further defined as "being PA 10.10 or PA 6.Y in which 6 denotes the residues of hexamethylene diamine and y denotes the residues of an aliphatic dicarboxylic acid having 10 to 18 carbon atoms".

Claim 1 of auxiliary request 5 differed from claim 1 of the main request in that the polyamide A1 of the outer layer was "chosen from PA-6,10 (having hexamethylenediamine and sebacic acid units), PA-6,14 (having hexamethylenediamine and C14 acid units), PA-6,18 (having hexamethylenediamine and C18 acid units) and PA-10,10 (having 1,10-decanediamine and

sebacic acid units)."

Claim 1 of auxiliary request 6 was based on claim 1 of the main request in which the polyamide A1 was further defined as "being chosen from PA-6,10 (having hexamethylenediamine and sebacic acid units)".

Claim 1 of auxiliary request 7 was based on claim 1 of new auxiliary request 3 for which the polyamide A1 was defined as in claim 1 of new auxiliary request 4.

Claim 1 of auxiliary request 8 differed from claim 1 of the main request in that the layer next to the outer layer was limited to "a layer of a PA-6/polyolefin blend" and in that the PA-6/polyolefin blends having a PA-6 matrix wasdefined as "comprising, the total being 100%:
- 50 to 90% PA-6;
- 1 to 30% HDPE; and
- 5 to 30% of at least one polymer P1 chosen from impact modifiers and polyethylenes,
at least one of the HDPE and P1 being completely or partly functionalized".

Further to these requests, the appellant introduced new auxiliary requests 11 to 35 corresponding to combinations of lower ranking auxiliary requests.

Also, a corrected version of D11 (named D11c thereafter) and further documents were submitted with that letter as follows:

D12: Document MatWeb listing ORGALLOY® Technical Data Sheets and dated 7 May 2013
D13: Tubes/Mandrels/Profiles/Cables, undated

X. Oral proceedings were held on 4 September 2018. During the oral proceedings the appellant filed new auxiliary requests 8 to 10 which corresponded to the claims of auxiliary requests 8 to 10 according to the numbering in the letter dated 27 July 2018 (in turn corresponding to auxiliary request 7 to 9 filed with the statement setting out the grounds of appeal) and an amended page 5 according to auxiliary request 1. Auxiliary requests 11 to 35 were withdrawn.

XI. The arguments provided by the appellant, as far as relevant to the present decision, can be summarised as follows:

Main request and auxiliary requests 1, 2, 3, 4 and 7

Novelty over D6

(a) The second layer of the multilayer structure according to example 1 of D6 did not anticipate the PA-6 layer or the layer of a PA-6/polyolefin blend having a PA-6 matrix according to claim 1 because the second layer disclosed in example 1 of D6 additionally contained a high-viscosity polyamide PA-6,12 and a polyethyleneimine/PA-6 copolymer which were not covered by claim 1.

(b) The description of the patent in suit made clear that layers made of polyamide PA-6 or of a PA-6/polyolefin blend having a PA-6 matrix could contain impact modifiers as well as specific additives. However, it would have been also clear for a skilled person that these layers could not contain components such as PA-6,12 or a polyethyleneimine/PA-6 copolymer, that would alter the known properties of PA-6 layers. In accordance thereto,

the patent in suit did not suggest the presence of any other component than the components cited in the description.

(c) In addition, the reference to the matrix in the layer of a PA-6/polyolefin blend having a PA-6 matrix implied that the polyamide PA-6 had to be present in an amount of at least 50% in the blend. In accordance thereto, the blend disclosed in the examples of the patent in suit, Orgalloy®, was a blend of 70% PA-6, 15% high density polyethylene (HDPE), 15% grafted ethylene propylene rubber (EPR) and also contained antioxidants. Since the second layer in example 1 of D6 was made of a blend containing a polyamide PA-6 in an amount of 48.1 wt% only, also for that reason the multilayer structure of that example did not anticipate claim 1 of the main request.

(d) Paragraph 92 of the patent in suit which contemplated the total replacement of PA-6 by PA-6,10/Z was not in line with claim 1 of the main request. Its disclosure was however not relevant to the novelty assessment as it was limited to PA-6,10/Z, which was not taught in D6.

(e) The same arguments applied to auxiliary requests 1, 2, 3, 4 and 7.

Admittance of D11c, D12 and D13

(f) D11c, D12 and D13 were filed in response to the communication sent by the Board. D11 contained an error that was corrected in the new version of the document. The correction did not affect the results reported in D11. D12 and D13 were of high relevance

as they showed that the term Orgalloy® corresponded to a whole family of polyamide products of different compositions, an information which was not provided in D8 since the reference to Orgalloy® in that document was only generic. On this basis, these documents should be admitted into the proceedings.

Auxiliary requests 5 and 6

Inventive step

(g) D6 represented the closest prior art. D6 aimed at a multilayer structure having two or more layers, one of which being an EVOH bonded to an outer layer composed of a molding composition based on PA-11, PA-12, PA-6,12, PA-10,12 or PA-12,12, without any use of a polyolefin layer as an adhesion promoter. The claimed subject matter differed from D6 in the composition of the outer layer.

(h) D11c was a test report of three multilayer structures based on polyamide layers separated by an EVOH layer. In particular, structure 1 of D11c represented claim 1 of the main request. Although that structure disclosed the presence of antioxidants, such as Polyad PB201, in the layers, the structure was according to the claimed subject matter since the presence of antioxidants was contemplated in the patent in suit. D11c showed that compositions based on outer layers comprising PA-6,10 led to multilayer structures having lower water uptake, improved barrier properties, improved zinc chloride resistance and improved processability as compared to the multilayer structure of example 1 of D6 so that the problem

solved was the provision of multilayer structures with improved water uptake, barrier properties, zinc chloride resistance and processability.

(i) D6 underlined the importance of selecting an outer layer adapted to the intermediate layer. With respect to the outer layer, the teaching of D6 was to use of PA-12. The patent in suit however intended to improve on the presence of PA-12 in the outer layer because of its lack of flexibility. D6 did therefore not lead to the claimed subject matter.

(j) The teaching of D3 was confined to multilayer structures having three layers. Example 1 of the patent in suit showed that these structures, as represented in structure 6, were less advantageous than the claimed structures since they required a thicker EVOH layer and an EVOH with a higher ethylene content in order to display sufficient adhesion to the outer layer.

(k) In view of the general teaching of D3, the skilled person would have at most adopted a three layer structure. Therefore, D3 did not lead to the solution provided in the patent in suit, so that claim 1 of auxiliary request 5 was inventive over D6.

(l) The same arguments applied to auxiliary request 6.

Auxiliary request 8

Inventive step

(m) D6 remained the document representing the closest prior art. Claim 1 of that request differed from D6 in the definition of the PA-6 blend. D11c established that multilayer structures according to claim 1 of auxiliary request 8 had improved properties as compared to the structure of example 1 of D6. The comparison of structures 2 and 3 in D11c in particular showed that the presence of an intermediate layer made of a PA-6/ polyolefin blend having a PA-6 matrix as defined in claim 1 resulted in an improvement of the water uptake, the barrier properties, the zinc chloride resistance and the processability of multilayer structures. The problem solved over D6 was the provision of multilayer structures with improved water uptake, barrier properties, zinc chloride resistance and processability.

(n) With respect to D11c, the ranking of the properties with help of qualitative grades was reliable and was not uncommon in the prior art. Since the respondent did not provide a rework of D11c that would invalidate its conclusions, D11c was a valid report in the assessment of inventive step.

(o) D8 did not lead to the claimed subject matter. In particular, D8 taught that the use of Orgalloy®, a family of composites, was known to improve the barrier properties of multilayer structures towards petrol only when these composites were used as inner layers. There was no indication in D8 to use any specific Orgalloy® that would fall under the

claimed composition and no incentive to use it in an intermediate layer. Claim 1 of auxiliary request 8 was therefore inventive over D6.

XII. The arguments of the respondent, as far as relevant to the present decision, can be summarised as follows:

Main request and auxiliary requests 1, 2, 3, 4 and 7

Novelty over D6

(a) Claim 1 lacked novelty over example 1 of D6. The wording of claim 1 did not exclude the presence of any other component alongside PA-6 or as part of the PA-6/polyolefin blend in the intermediate layer. In accordance thereto, the description of the patent in suit, in several instances, referred to the additional presence of components such as elastomers and additives in PA-6 compositions. As to the PA-6 blend, the patent in suit also contemplated the partial or total replacement of PA-6 by PA-6,10/Z.

(b) The second layer of the structure of example 1 of D6, besides PA-6, contained a high-viscosity polyamide PA-6,12 and a polyethyleneimine/PA-6 copolymer which were not excluded from the PA-6 layer as defined in claim 1. Claim 1 of the main request did also not contain any limitation regarding the amount of PA-6 in the layer. In view of this, it could not be read as implying that the PA-6 had to be present in an amount of more than 50 wt%.

(c) The intermediate layer of example 1 of D6 anticipated therefore both a PA-6 layer as well as

a layer of a PA-6/polyolefin blends having a PA-6 matrix according to claim 1.

(d) The same arguments applied to auxiliary requests 1, 2, 3, 4 and 7.

Admittance of D11c, D12 and D13

(e) D11c, D12 and D13 were filed late during appeal proceedings. D11c was also not relevant because it did not establish that an error had been made in D11. It was also not in the form of a declaration by the person having conducted the experiments. The information derivable from D12 was not relevant since it reflected a content available long after the priority date of the patent in suit. Since D13 was undated, it could not be concluded that its content had been made available to the public at the priority date of the patent in suit. On this basis, D11c, D12 and D13 should not be admitted into the proceedings.

Auxiliary requests 5 and 6

Inventive step

(f) D6 represented the closest prior art. The claimed multilayer structure differed from that of example 1 of D6 in that the outer layer was based on specific polyamides. The patent in suit did not show any effect resulting from the choice of these polyamides in the outer layer. D11c described several multilayer structures which differed by more than one feature from the structure representing example 1 of D6. These tests could therefore not establish that any effect described

in D11c was the result of the distinguishing feature over D6. The problem was therefore to find alternative multilayer structures to those of D6.

(g) D3 related to multilayer structures displaying the same properties as the structures of both D6 and the patent in suit. D3 taught that outer layers made of PA-6,10 or PA-6,12 displayed similar properties. The skilled person was therefore taught to use PA-6,10 as an alternative to PA-6,12 in the outer layer. Claim 1 of auxiliary request 5 therefore lacked an inventive step.

(h) The same arguments applied to auxiliary request 6.

Auxiliary request 8

Inventive step

(i) D6 was the closest prior art. The claimed subject matter specified the composition of the blend. The outer layers of all the structures described in D11c contained an antioxidant, polyad PB201, that did not belong to the components listed in claim 1. On that basis, D11c was not relevant to the question of inventive step since none of the structures disclosed therein was according to claim 1 of auxiliary request 8.

(j) Also, the characterization of the properties of the tested structures in qualitative terms in D11c was not accurate enough to draw a meaningful conclusion as to the performance of the individual structures when compared to one another.

(k) The problem solved over the closest prior art was thus the provision of alternative multilayer structures.

(l) D8 taught that Orgalloy® improved the barrier properties of multilayer structures. The skilled reader of D8 derived therefrom that the advantages resulting from the presence of a layer containing Orgalloy was not limited to its use as an inner layer. Furthermore, D6 and D2 already suggested that an intermediate layer based on compositions of polyolefin containing polyamides improved adhesion to the outer layer. The teaching provided in D8 was sufficient to motivate the skilled person to add an intermediate layer based on Orgalloy® in a multilayer structure. The claimed subject matter lacked therefore an inventive step over D6.

XIII. The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request filed with the statement of grounds of appeal, or, on the basis of either auxiliary request 1 or 2 including the claims of the main request and an amended description as filed with the letter of 27 July 2018, or, on the basis of any of auxiliary requests 3 to 7 corresponding to auxiliary requests 2 to 6 filed with the statement of grounds of appeal or, auxiliary requests 8 to 10 filed during the oral proceedings on 4 September 2018.

XIV. The respondent requested that the appeal be dismissed.

## Reasons for the Decision

Main request and auxiliary requests 1, 2, 3, 4 and 7

1. Novelty in view of D6

1.1 Claim 1 of the main request filed with the statement setting out the grounds of appeal corresponds to claim 1 as granted and to claim 1 of the main request filed on 27 April 2015 which was found to lack novelty over example 1 of D6 by the opposition division.

1.2 Claim 1 concerns a multilayer structure in which the inner layer is in contact with the petrol or diesel and comprising, in succession from the outside inwards an outer layer, a PA-6 layer or a layer of a PA-6/ polyolefin blend having a PA-6 matrix (hereafter referred to as the intermediate layer), an EVOH layer, and a further PA-6 layer or a layer of a PA-6/ polyolefin blend having a PA-6 matrix.

1.3 The contested decision of the opposition division concluded that claim 1 of the main request lacked novelty over example 1 of D6 which disclosed a 4-layer structure wherein:
- the outer layer comprised PA-6,12 (corresponding to A1 wherein Z=0),
- the second layer comprised 35.3 wt% VESTAMID® D22 (a PA-6,12), 48.1 wt% ULTRAMID® B5W (a PA-6), 10.7 wt% of a polyethyleneimine/PA-6 copolymer, and 5.4 wt% EXXELOR® VA1803 (a functionalized polyolefin and impact modifier),
- the third layer comprised EVAL® F101 (an EVOH) and

- the fourth layer was a plasticized and impact modified PA-6 layer (paragraphs 71, 73 and 74 on page 8 of D6).

1.4 The finding of the opposition division was that the second layer disclosed in example 1 of D6 corresponded to the intermediate layer as defined in claim 1 of the main request because the terms "PA-6 layer" and "PA-6/ polyolefin blend having a PA-6 matrix" in claim 1 were considered non-limiting so that they could encompass any type of additional components. It was not contentious in opposition, nor in appeal proceedings, that the other three layers were according to claim 1.

1.5 As to the intermediate layer, while both parties agreed in appeal that the wording used in claim 1 allowed for the presence of further components alongside the PA-6 or the PA-6/polyolefin blend having a PA-6 matrix in the layer, the main point of contention was whether the terms "PA-6 layer" and "layer of a PA-6/polyolefin blend having a PA-6 matrix" encompassed the components of the second layer of example 1 of D6.

1.6 Claim 1 of the main request defines the intermediate layer located between the outer layer and the EVOH layer of the multilayer structure only in that it is "a PA-6 layer or a layer of a PA-6/polyolefin blend having a PA-6 matrix". Beyond the presence of PA-6 or a PA-6/ polyolefin blend having a PA-6 matrix in the intermediate layer, claim 1 does not limit the number nor the amounts of additional components in the layer. In that regard, while the formulation chosen to define the intermediate layer of claim 1 of the main request may be broad, it is however not so unclear as to render an interpretation of the formulation "a PA-6 layer or a layer of a PA-6/polyolefin blend having a PA-6 matrix"

in the light of the description necessary. In view of the lack of a limitation, the Board does not see any reason to conclude that the second layer disclosed in example 1 of D6 does not fall under the intermediate layer of claim 1 of the main request.

1.6.1 In any case, even considering the arguments of the appellant that were based on the description, the Board arrives at the same conclusion.

(a) It was argued that a skilled reader would understand from the description that only those components mentioned therein could be present alongside PA-6 in the intermediate layer. While it is correct that the description of the patent in suit does not mention the possible presence of a PA-6,12 and a polyethyleneimine/PA-6 copolymer as in example 1 of D6, it does however not suggest in any way that these two polymers are excluded from the intermediate layer, nor that the mentioned components are the only possible additional components (see paragraphs 82 to 84 and 92 of D6 indicating preferred embodiments).

(b) It was further argued that it was understood that any component expected to alter the properties of PA-6 was excluded from the layer. However, that interpretation of claim 1 would contradict the description itself since its paragraphs 82 and 84 teach the presence of impact modifiers, such as EPR or EPDM, or very low density polyethylene, in the PA-6 layer, which role is precisely to affect the properties of the compositions they are added to. The Board therefore also concludes from the information contained in the description that PA-6,12 and polyethyleneimine/PA-6 copolymers are

not excluded from the PA-6 layer or layer of a PA-6/polyolefin blend having a PA-6 matrix of the intermediate layer of claim 1 of the main request.

1.6.2 With regard to the PA-6/polyolefin blend having a PA-6 matrix, it was not plausibly shown that a skilled person would have read claim 1 with a limitation as to the minimum amount of PA-6 in the intermediate layer on the grounds that PA-6 was the matrix of the blend. Paragraph 83 of the patent in suit mentions the presence of 50-90% of PA-6 in the PA-6/polyolefin blends having a PA-6 matrix, but it is clear that that passage only concerns a preferred embodiment and thus does not provide a general definition of the PA-6 matrix in the context of claim 1 of the main request. Paragraph 92 of the patent in suit actually renders the concept of the PA-6 matrix in the PA-6/polyolefin blend more ambiguous as it indicates that "it would not be outside the scope of the invention to replace the PA-6 completely or partly with PA-6,10/Z of the invention" and thereby suggests that a PA-6 matrix could possibly be a minor component of the layer. The description does therefore not support the argument of the appellant wich regard to the minimum amount of PA-6 in the intermediate layer.

1.6.3 Besides, since PA-6 (ULTRAMID® B5W) in the second layer according to example 1 of D6 is the component that is present in the highest amount (48.1 wt%) alongside smaller amounts of PA-6,12 (35.3 wt%), the polyethyleneimine/PA-6 copolymer (10.7 wt%) and the maleic-anhydride-functionalized ethylene-propylene rubber impact modifier (5.4 wt%), it is reasonable to consider that layer as a layer of PA-6/polyolefin blend having a PA-6 matrix.

1.7 The Board concludes that the second layer of example 1 of D6 can be seen as both a PA-6 layer and a layer of PA-6/polyolefin blend having a PA-6 matrix. It follows therefrom that claim 1 of the main request lacks novelty over example 1 of D6.

1.8 Auxiliary requests 1 and 2 correspond to the main request to which a modified page 5 of description (auxiliary request 1) or page 9 (auxiliary request 2) was provided. The modifications of the description in these requests do not modify the scope of claim 1. The conclusion of the Board as to the lack of novelty of claim 1 of the main request therefore also applies to auxiliary requests 1 and 2.

1.9 Claim 1 of auxiliary request 3 differs from claim 1 of the main request in that the composition of the PA-6/ polyolefin blend having a PA-6 matrix of the intermediate layer is further defined as comprising, the total being 100%:
- 50 to 90% PA-6;
- 1 to 30% HDPE; and
- 5 to 30% of at least one polymer P1 chosen from impact modifiers and polyethylenes,
at least one of the HDPE and P1 being completely or partly functionalized.

1.10 Since the intermediate layer however can alternatively still be a "PA-6 layer", as in claim 1 of the main request, the conclusion reached by the Board on lack of novelty still applies to claim 1 of auxiliary request 3 inasmuch as the intermediate layer is a PA-6 layer. Therefore also auxiliary request 3 lacks novelty over example 1 of D6.

1.11 Claim 1 of auxiliary request 4 differs from claim 1 of the main request in that the polyamide A1 defining the composition of the outer layer is "PA 10.10 or PA 6.y in which 6 denotes the residues of hexamethylene diamine and y denotes the residues of an aliphatic dicarboxylic acid having from 10 to 18 carbon atoms". It was not disputed that the outer layer of the multilayer structure disclosed in example 1 of D6 already anticipates the outer layer as defined in claim 1 of auxiliary request 4 since the outer layer in example 1 of D6 contains PA-6,12 (page 8, line 51). Under these circumstances, the Board arrives to the conclusion that claim 1 of auxiliary request 4 lacks novelty over D6 for the same reasons as outlined for the main request.

1.12 Claim 1 of auxiliary request 7 (dealt with here for practical reasons and in any case relevant in view of the lack of inventive step for auxiliary requests 5 and 6, see point 3 below) differs from claim 1 of the main request in that the polyamide A1 of the outer layer is defined as in auxiliary request 4 and the PA-6/polyolefin blend having a PA-6 matrix is defined as in auxiliary request 3. It has already been concluded above (points 1.9 and 1.11) that these two limitations were independently anticipated by example 1 of D6. As a result, claim 1 of auxiliary request 7 lacks novelty over D6 as well.

2. Admittance of D11c, D12 and D13

2.1 The corrected version of the test report D11 (D11c) as well as D12 and D13 were provided with the reply of the appellant dated 27 July 2018, after oral proceedings had been arranged by the Board. Their admittance into the proceedings, which was contested by the respondent,

therefore undergoes the stipulations of Article 13(1) and (3) RPBA.

2.2 D11c essentially corresponds to D11 filed with the statement setting out the grounds of appeal, with the only difference that the reference to 15% of catalyzed PA-11 containing 600 ppm of phosphoric acid in the PA-6 composition of the inner layer of structures 2 and 3 was deleted. Apart from that, the multilayer structures and the results of the tests reported in D11c remain identical to those of D11. The Board finds that the amendment provided in D11c does not add complexity to the analysis of the test report that the respondent and the Board could not be reasonably be expected to deal with at the oral proceedings. Besides, since the amendment performed in D11c equally concerns the inner layer of both structure 2 according to the patent in suit and structure 3 according to example 1 of D6, it has no influence on the conclusions drawn from a comparison of these two structures. The Board thus finds appropriate to exercise its discretion under Article 13(1) RPBA by admitting D11c into the proceedings.

2.3 As to D12 and D13, the appellant argued that they were filed as a response to the communication of the Board according to Article 15(1) EPC in order to establish that the term Orgalloy® corresponded to a whole family of polyamide products of different compositions, an information which was otherwise not provided in D8, since the reference to Orgalloy® in that document was only generic.

2.3.1 The argument of the appellant regarding the admittance of D12 and D13 does not convince, since Orgalloy® or any question relating to the identity of that product

or line of products was nowhere addressed in the communication of the Board. In this respect, the brief reference to the possible relevance of D8 for the inventive step assessment of auxiliary request 5 in point 12.2.8 of the communication ("It will then have to be discussed if the solution provided to that problem is obvious in view of the prior art. D2 and D8 may have to be considered in that respect.") cannot be seen as a point that could have prompted the appellant to file D12 and D13.

2.3.2 Besides, the question of whether the skilled person would have considered the use of Orgalloy® disclosed in D8 as a component of the intermediate layer according to D6 had already been extensively dealt with in the decision of the opposition division on inventive step (see points 5.4.3 and 5.4.5 of the contested decision). That issue was thus not new to the appeal proceedings. D12 and D13 therefore could and should have been filed at the latest with the reply to the statement of grounds of appeal and not around a month before the oral proceedings before the Board. Furthermore, D12 was published after the priority date of the patent in suit and D13 does not bear a publication date. Since there is no justification for the filing of these documents at such a late stage, the Board finds it appropriate to exercise its discretion under Article 13(1) RPBA by not admitting these documents into the proceedings.

Auxiliary requests 5 and 6

3. Inventive step

3.1 Auxiliary request 5 corresponds to auxiliary request 4 filed with the statement setting out the grounds of appeal whose admittance into the appeal proceedings was

initially contested in the rejoinder to the appeal but was no longer contested at the oral proceedings before the Board. Since the respondent did not finally contest the admittance of auxiliary request 5, that request is in the proceedings under Article 12(1) RPBA and there is no need for the Board to discuss the issue any further.

3.2 Claim 1 of auxiliary request 5 differs from claim 1 of the main request, which also corresponds to claim 1 as granted, in that the polyamide A1 comprised in the composition of the outer layer is "chosen from PA-6,10 (having hexamethylenediamine and sebacic acid units), PA-6,14 (having hexamethylenediamine and C14 acid units), PA-6,18 (having hexamethylenediamine and C18 acid units) and PA-10,10 (having 1,10-decanediamine and sebacic acid units)".

3.3 Both the patent in suit and D6 relate to multilayer structures based on an association of an outer layer with an EVOH barrier layer so as to provide adhesion between the layers (patent in suit: paragraph 30; D6: paragraph 9) and heat resistance (patent in suit: paragraph 9; D6: paragraph 10). D6 was considered as the closest prior art in the decision of the opposition division and was also seen as the closest prior art by both parties in appeal. The Board does not see a reason to depart from D6 as the closest prior art, and in particular from the multilayer structure of its example 1.

3.4 Example 1 of D6 discloses a multilayer structure in which the polyamide of the outer layer is PA-6,12 (see point 1.3, above). Since PA-6,12 is not part of the polyamides listed under claim 1 and defining polyamide A1 of the outer layer, the Board is satisfied that

claim 1 of auxiliary request 5 is novel over D6 and that its characterizing feature over that document is precisely the polyamide A1. This conclusion was not contested in appeal.

3.5 Example 1 of the patent in suit describes six multilayer structures based on PA-6,10 as the polyamide of the outer layer. Among these multilayer structures, only structures 3, 4 and 5 are relevant to auxiliary request 5 since these are the only structures having four layers as defined in claim 1 of auxiliary request 5. While example 1 discloses that the advantage of the multilayer structures 3, 4 and 5 based on PA-6,10 resides in the absence of a dedicated tie layer (paragraph 114), it is nowhere shown that these structures are improved in any way over structures based on PA-6,12 as disclosed in example 1 of D6. Paragraph 114 even suggests that replacing PA-6,10 with PA-6,12 in structures 3, 4 and 5 leads to structures of equally satisfying adhesion.

3.6 Example 2 of the patent in suit does not concern multilayer structures. That example however provides a comparison of flexural modulus, thermomechanical and ageing properties of formulations based on PA-6,12, PA-6,10 and PA-10,10 polyamides. Although the results reported in paragraph 116 seem to show a difference in the properties of PA-6,12 as compared to PA-6,10, it is unclear if that difference would actually still be observed in corresponding multilayer structures. It can thus not be concluded therefrom that an effect was established for the multilayer structures of auxiliary request 5 over that of example 1 of D6.

3.7 Test report D11c discloses three multilayer structures, one of which having an outer layer comprising PA-6,10

(structure 1) and the two others comprising PA-6,12 instead (structures 2 and 3). In that respect, structure 1 is according to claim 1 of auxiliary request 5. By contrast, structure 3 represents the multilayer structure of the closest prior art.

3.8 Each of these multilayer structures was tested for its water uptake, barrier properties, zinc resistance and processability and the results are reported in the table on page 2 of D11c. While the properties reported for structures 1 and 3 are qualitatively differentiable, these differences cannot be unequivocally attributed to the characterizing feature, the choice of the polyamide forming part of the outer layer, because the compositions of the inner layers of structures 1 and 3 also differ from one another. Indeed, the inner layer of structure 1 contains, in addition to PA-6, 15% of HDPE and 15% of a grafted ethylene propylene rubber. These two polymers, are absent from the inner layer of structure 3. Since the properties reported in D11c were measured on whole multilayer structures, it cannot be concluded that any effect on the properties of the multilayer structures is attributable to the use of PA-6,10 instead of PA-6,12 in the outer layer. D11c does therefore not establish the presence of improved properties in the claimed multilayer structures in comparison with the closest prior art.

3.9 Since there is no evidence showing that the choice of the specific polyamide A1 in the list defined in claim 1 of auxiliary request 5 has as such an effect over the use of PA-6,12 as disclosed in example 1 of D6, the problem solved over the closest prior art can only be seen as the provision of further multilayer

structures.

3.10 It remains to be determined whether the solution provided in claim 1 of auxiliary request 5 is inventive in view of the cited prior art. To that extent, the question to be answered is whether the skilled person, starting from D6 and aiming at solving the problem as formulated above, would be led to the claimed multilayer structure by the available prior art. D3 was cited by the respondent in that respect.

3.11 D3 concerns improvements relating to multilayer articles having good barrier and adhesion properties (page 2, lines 5 and 6). D3 teaches that the combination of a barrier layer of ethylene-vinyl alcohol (EVOH) with an outer layer of PA-6,12 or PA-6,10 and an inner layer of PA-6, PA-6,12 or PA-6,10 provides an article having excellent heat resistance, barrier properties to permeation by hydrocarbon, with good adhesion between the layers (page 2, lines 21-25). That general teaching is also reflected in the examples of D3 and in particular example 7 dealing with an application of the multilayer structures for fuel tubes and for which tubes having outer layers of PA-6,10 and PA-6,12 are described as having similar properties. D3 therefore generally teaches the use of PA-6,10 in an outer layer of a multilayer structure close to those of D6 as an alternative to PA-6,12. Since there is no teaching against the use of PA-6,10 in place of PA-6,12 in D6, the skilled person confronted with the problem of providing further multilayer structures would have considered the use of polyamide PA-6,10 as taught in D3.

3.12 While it is true that D3 discloses that the inner and outer layers are bonded directly to the barrier layer

without intermediate adhesive layers, it is clear that such an arrangement is only chosen to simplify the manufacture of multilayer articles (page 2, lines 8-10). The absence of an adhesive layer in the multilayer structure of D3 is not a precondition to the use of PA-6,10 as an outer layer material. It can also not be derived from D3 that the equivalence of PA-6,10 with PA-6,12 as an outer layer material would in any way be affected by the presence or absence of an adhesive layer. Thus, the Board does not find that D3 could have only prompted the skilled person to use PA-6,10 as an outer layer material in the context of a multilayer structure having no adhesive layer.

3.13 Claim 1 of auxiliary request 5 lacks therefore an inventive step over D6 as the closest prior art in combination with the teaching of D3.

3.14 In claim 1 of auxiliary request 6, the polyamide A1 of the outer layer is limited to PA-6,10 having hexamethylenediamine and sebacic acid units only, deleting the other options in the list of polyamides contained in claim 1 of auxiliary request 5. The Board already concluded for auxiliary request 5 that the selected embodiment (with PA-6,10 as an outer layer material) lacked an inventive step in view of D6 and D3. That conclusion also applies thus directly to claim 1 of auxiliary request 6. In that respect, the parties did also not provide any further arguments regarding inventive step of that request.

Auxiliary request 8

4. Inventive step

4.1 Since auxiliary request 7 lacks novelty over D6 (see point Error: Unable to retrieve cross-reference value! above), the next request in line is auxiliary request 8, against which no novelty objection was raised in appeal.

4.2 It was not disputed that D6 was still the document representing the closest prior art for the subject matter of auxiliary request 8. Claim 1 of auxiliary request 8 differs from example 1 of D6 in the amended feature, namely the composition of the intermediate layer, a PA-6/polyolefin blend having a PA-6 matrix comprising, the total being 100%:
- 50 to 90% PA-6;
- 1 to 30% HDPE; and
- 5 to 30% of at least one polymer P1 chosen from impact modifiers and polyethylenes,
at least one of the HDPE and P1 being completely or partly functionalized.

4.3 With respect to the problem solved, structures 2 and 3 of the test report D11c solely differ from one another in the composition of the intermediate layer.

4.3.1 In particular, the composition of the intermediate layer of structure 2 is made of Orgalloy®, a blend of 70% PA-6, 15% HDPE and 15% grafted EPR also containing antioxidants. In that respect, structure 2 of D11c is according to claim 1 of auxiliary request 8.

4.3.2 While it is true that claim 1 of auxiliary request 8 does not explicitly list the presence of antioxidants in the compositions of both outer and intermediate layers, the open formulation chosen for each the compositions of these layers ("comprising") allows for the presence of antioxidants in any amount as long as the total amount of the components present in the composition sums up to 100%. The Board concludes therefore that the layers of structure 2 are according to claim 1 of auxiliary request 8.

4.3.3 Structure 3 of D11c is based on an intermediate layer of composition 1, a mixture of 35.3% by weight of PA-6,12 VESTAMID® D22, 48.1% by weight of PA-6 ULTRAMID® B5W, 10.7% by weight of the polyethyleneimine/PA-6 copolymer and 5.4% by weight of ethylene propylene rubber EXXELOR® VA1803. That composition is according to example 1 of D6.

4.4 The table on page 2 of D11c reports the results relative to water uptake, barrier property, zinc resistance and processability for each of the multilayer structures and ranks these results in qualitative terms from very bad to very good. It is correct that the appellant chose in D11c not to include numerical data in relation to the properties measured. However, that as such is not a reason to reject any conclusion that can be drawn up on the basis of the reported ranking as the Board has no reason to question the legitimacy of the tests conducted in D11c and no counter tests have been provided by the respondent. In that respect, the results reported clearly establish that structure 2 according to claim 1 of auxiliary request 8 displays improved water uptake (mark quite good), zinc resistance (mark bad) and processability (mark very good) when compared to structure 3

representing the closest prior art (marks bad, very bad and good for these properties, respectively). Contrary to the argument of the respondent, these properties are derivable from the patent in suit, in particular from paragraph 14 for the water uptake and zinc resistance and from paragraph 9 for the processability (good convertibility in extrusion). Under these circumstances, the problem shown to be solved is the provision of of multilayer structures having improved water uptake, zinc resistance and processability.

4.5 As to the question of obviousness, D8 was cited by the respondent as providing the solution to the problem posed. D8 is an article relating to the permeability of polymer blends, in particular those blends sold under the generic tradename Orgalloy® in multilayer structures, for example those used for the transport of petrol in cars (first two columns). D8 shows that blends of polyamides, and in particular PA-6, with polyolefins have improved permeability and barrier properties than any of the these two polymers alone (Figures 2 to 4). D8 however does not specify the composition of any of the Orgalloy® blends whose properties are described. Since it was not shown that all Orgalloy® blends have a composition falling under that of claim 1, it cannot be concluded that D8 suggests the use of a composition according to that claim, all the more so as the advantages of using Orgalloy® in multilayer structures as mentioned in D8 do not form part of the definition of the problem posed for the claimed subject matter in view of D6. In addition, Figure 1 is the only instance in D8 in which a layer of an Orgalloy® blend is disclosed. On that figure, a generic Orgalloy® blend is only used as an inner layer. There is thus no disclosure of an intermediate layer having the claimed composition in

D8. On that basis, a skilled person would not have arrived at the claimed subject matter to solve the problem posed. Claim 1 of auxiliary request 8 is inventive over D6.

4.6 Claim 14 of auxiliary request 8 pertains to a use of the multilayer structure according to claims 1 to 4, 12 and 13 and claim 15 relates to a device for storing or transferring petrol and diesel comprising a multilayer structure according to any one of claims 1 to 11. These claims are inventive over D6 for the same reasons as outlined for claim 1. The Board concludes from the above that auxiliary request 8 satisfies the requirements of Article 56 EPC.

5. Article 123(2) EPC

5.1 The objection of the respondent under Article 123(2) EPC was made moot by the amendment of page 5 of the description in which the term "EVOH" was replaced by "next" in paragraph 30 in accordance with the text of the application as originally filed. As no objection under Article 123(2) EPC was raised by the respondent against auxiliary request 8, the Board sees no reason to discuss the issue any further.

**Order**

**For these reasons it is decided that:**

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to maintain the patent on the basis of the claims and page 5 according to auxiliary request 8 filed during the oral proceedings on 4 September 2018 and after any necessary consequential further amendments of the description.

The Registrar: The Chairman:

B. ter Heijden D. Semino

Decision electronically authenticated