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# Datasheet for the decision of 1 October 2021

**Case Number:** T 1035/19 - 3.3.09

**Application Number:** 05028435.5

**Publication Number:** 1801146

**IPC:** C08J9/00, C08J9/08

**Language of the proceedings:** EN

**Title of invention:**
GLASS FIBRE REINFORCED POLYPROPYLENE FOAM

**Patent Proprietor:**
Borealis Technology Oy

**Opponents:**
SABIC Global Technologies B.V. /
SABIC Petrochemicals B.V.

**Headword:**
Reinforced polypropolyene foam/BOREALIS

**Relevant legal provisions:**
EPC Art. 100(b), 111(1)
RPBA Art. 12(4)
RPBA 2020 Art. 11, 13(2)

**Keyword:**
Grounds for opposition - insufficiency of disclosure (no)
Remittal - (yes)

**Decisions cited:**
T 0492/92, T 0061/14, T 1943/15

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

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**Case Number: T 1035/19 - 3.3.09**

# D E C I S I O N
# of Technical Board of Appeal 3.3.09
# of 1 October 2021

| | |
|---|---|
| **Appellant:** (Patent Proprietor) | Borealis Technology Oy<br>P.O. Box 330<br>06101 Porvoo (FI) |
| **Representative:** | Kador & Partner PartG mbB<br>Corneliusstraße 15<br>80469 München (DE) |
| **Respondents:** (Opponents) | SABIC Global Technologies B.V. /<br>SABIC Petrochemicals B.V.<br>Plasticlaan 1 / Europaboulevard 1<br>4612 PX Bergen op Zoom / 6135 LD Sittard (NL) |
| **Representative:** | Sabic Intellectual Property Group<br>Sabic Intellectual Property Department<br>P.O. Box 3008<br>6160 GA Geleen (NL) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted on 25 February 2019 revoking European patent No. 1801146 pursuant to Article 101(3)(b) EPC.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | A. Haderlein |
| **Members:** | C. Meiners |
| | D. Rogers |

## Summary of Facts and Submissions

I. The appeal was filed by the patent proprietor (appellant) against the opposition division's decision to revoke European patent No. 1 801 146.

II. With their notice of opposition, the opponents (respondents) had requested that the patent be revoked in its entirety, *inter alia*, on the ground for opposition under Article 100(b) EPC (lack of sufficiency of disclosure).

III. The following documents, cited by the parties in the opposition and appeal proceedings, are relevant to the present decision:

D1 US2002/0035164 A1

D2 ASTM C-518-98

D3 ASTM C-177-97

D7 Datasheet for polypropylene Nepol™ GB415HP

D8 Physical Properties of Polymers Handbook edited by James E. Mark (1996). Chapter 10. Thermal conductivity by Yong Yang, pp. 111-117

D9 J. L. Thomason *et al.*, Composites: Part A 27 A (1996) 477-484

D10 O. Almanza *et al.*, Journal of Macromolecular Science, Part B (2001), vol. 40:3-4, 603-613

D12 K. Morimoto *et al.*, Polymer Engineering and Science (1984), vol. 24, no. 12, 943-949

D14 OTC14121 Development and Qualification of Novel Thermal Insulation Systems for Deepwater Flowlines and Risers based on Polypropylenes, by Allan Boye Hansen and Cecilia Rydin. Presented at the 2002 Offshore Technology Conference held in Houston Texas USA, 6-9 May 2002

D17 Standard ISO 527-2:1993; Plastics - determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics

D23 Datasheet (in Chinese) for Nepol™ GB415HP

D28 Datasheet for Fibremod™ GB601HP

D29 Experimental report, including Annexes 1 and 2, filed with the grounds of appeal

IV. The appellant submitted auxiliary requests 1 and 2 with a letter dated 3 June 2020.

V. Claim 1 of the main request (claim 1 as granted) reads as follows:

"A foamed polypropylene composition comprising a propylene homo- and/or copolymer and glass fibres, wherein
(i) the composition has a density of 50 to 950 kg/$m^3$,
(ii) the tensile modulus $tm_{(extrusion\ direction)}$ measured according to ISO 527 in extrusion direction and the k-value measured according to ASTM C-177 satisfy the relation:
$tm_{(extrusion\ direction)}$ [MPa]/k [W/mK] $\geq$ 9000 MPa·mK/W, and
(iii) the glass fibres are present in an amount of from 1 to 30 wt.% of the total composition."

VI. The appellant's arguments, where relevant to the decision, may be summarised as follows.

The invention could be carried out across the full breadth of the claims without imposing an undue burden. The allegedly missing information in the patent on the type of polypropylenes, ratio of blowing agent/polymer, type and length of the glass fibres, orientation of glass fibres in the foam, type of blowing agent/gas in the foam cells, sample preparation for the tensile modulus measurement and determination of the k-value did not entail essential features for carrying out the invention. Any differences in preparing the test specimens and carrying out the measurements at most influenced the accuracy of determining the claimed ratio of $tm_{(extrusion\ direction)}/k$ rather than the ability of the skilled person to carry out the claimed subject-matter. Thus, the disclosure was sufficient.

Documents D23 and D28 should not be admitted. Moreover, the respondents' submissions under chapters II.1, II.2, III.2 and III.3 (items 246 to 266) of their letter dated 1 September 2021 should not be taken into account by the board. These were not put forward in the reply to the statement setting out the grounds of appeal and were not a reaction to any issue discussed in the board’s preliminary opinion.

If the board sets aside the decision of the opposition division, the case should be remitted to the opposition division for assessment of the undecided grounds for opposition.

VII. The respondents' arguments, where relevant to the decision, may be summarised as follows.

The patent provided no teaching on how to reduce the subject-matter of claim 1 to practice without imposing

an undue burden. Example 2 of the patent could not be reworked. There was evidence and plausible suspicion that, due to the influence of the type(s) of polypropylene; ratio of blowing agent to polymer; type, amount, orientation and length of the glass fibres; density of the foam compositions; and sample preparation and experimental details of the test methods on the $tm_{(extrusion\ direction)}/k$ ratio, the claimed subject-matter could not be carried out over the full scope of claim 1.

The new line of argument regarding the ASTM methods used for the measurement of the coefficient of thermal conductivity (k-value) set out by the appellant in the grounds of appeal should not be taken into account by the board. This line of argument could have been provided during the opposition proceedings and especially during the oral proceedings before the opposition division where this issue had been discussed in detail.

D29 could have been filed in the proceedings before the opposition division. This document should thus not be admitted either. If D29 were taken into account by the board, D28 should also be admitted.

Furthermore, D23, which had not been admitted by the opposition division, should be taken into account. This document related to the glass fibre masterbatch used in the examples of the patent and was thus relevant.

The case should be remitted to the department of first instance if the board were to conclude that the patent was sufficiently disclosed.

VIII. Final requests

The requests of the appellant were to set aside the decision under appeal and to maintain the patent as granted (main request) or, alternatively, to maintain the patent upon the basis of auxiliary request 1 or 2, both filed under cover of the letter dated 3 June 2020.

The respondents requested that the appeal be dismissed.

## Reasons for the Decision

### Main request

*1. Admissibility of arguments relating to the measurement of the k-value put forward by the appellant*

The respondents requested that the appellant's new line of argument, set out for the first time in the grounds of appeal, on the measurement of the k-value not be taken into account.

The board notes that the objected line of argument had been put forward in the statement setting out the grounds for appeal, dated 5 July 2019, thus before the entry into force of the RPBA 2020. In view of the transitional provisions of Article 25(2) RPBA 2020, the provisions of Article 12(4) RPBA 2007 apply in this case. This provision, however, does not provide for not taking into account such arguments which could have been presented in the first-instance proceedings.

Consequently, the board sees no legal basis for the request of the respondents to disregard the mentioned submission of the appellant regarding the measurement of the k-value.

The board thus takes the arguments of the appellant into account.

2. *Admissibility of submissions in respondents' letter of 1 September 2021*

The appellant requested that the board not take into account the submissions provided under points 246 to 266 of respondents' letter dated 1 September 2021.

The board observes that these submissions are to be regarded as arguments which can be considered a development of the original arguments and not as an amendment to the party's case within the meaning of Article 13(2) RPBA 2020. The board thus takes these submissions into account.

3. *Admissibility of documents D23, D28 and D29*

3.1 The appellant did not request in the first-instance proceedings that document D23, unlike other documents filed by the opponents after expiry of the opposition period pursuant to Article 99(1) EPC, not be admitted (see point 11 of the impugned decision). The opposition division did not admit the documents which the proprietor had requested not be admitted into the opposition proceedings. The board therefore takes the view that the opposition division implicitly took D23 into account by excluding from the proceedings only the documents for which a request for non-admission was

submitted by the proprietor. The board thus does not see any reasons not to take D23 into account.

3.2 Document D28 was cited by the respondents with the reply to the statement setting out the grounds of appeal as a reaction to the filing of document D29 by the appellant. It could not have been cited earlier as there was no reason to submit a datasheet for a polypropylene glass fibre masterbatch Fibremod™ GB601HP in the first-instance proceedings.

Consequently, the board takes D28 into account (see Article 12(4) RPBA 2007).

3.3 Document D29 was submitted by the appellant with the statement setting out the grounds of appeal as a reaction to the opposition division's decision to revoke the impugned patent. D29 demonstrates that a skilled person can vary the type of polypropylene matrix, amounts of blowing agent and glass fibres plus the length of the glass fibres employed, producing foam composites all falling within the scope of claim 1 as granted. The experiments provided in D29 address the opposition division's objections put forward under point 29 of its decision. In its decision, the opposition division concluded that "the opposed patent does not provide any specific guidance other than one specific example regarding important parameters of the composition, forcing the skilled person to an undue burden of searching for the successful conditions when willing to perform the invention over the whole scope of claim 1".

Consequently, the board holds that D29 is highly relevant to the case under appeal and that the document was submitted at the earliest possible time in the

proceedings, i.e. as a reaction to the objections raised by the opposition division in its decision. The board thus takes D29 into account (Article 12(4) RPBA 2007).

*4. Sufficiency of disclosure (Article 100(b) EPC)*

4.1 Example 2 allegedly not falling within the scope of claim 1

The respondents argued that there was not a single example in the patent in suit according to the claimed subject-matter since the k-values had been determined according to ASTM C-518 in the patent and not, as required in claim 1, according to ASTM C-177.

It is true that it cannot be derived from the information provided in the patent and in particular in paragraph [0060] that ASTM C-177 was applied for the sample preparation in the examples of the patent. ASTM C-518 (see D2) and ASTM C-177 (see D3) both require the measurement of the heat flow through a sample specimen positioned between two thermally conducting metal plates held at different temperatures. While ASTM C-518 relates to a secondary test method (involving the use of a heat flow meter requiring the calibration of the heat flux transducers), ASTM standard C-177 relies on the absolute determination of the heat flow and thus constitutes a primary test method. In heat flux measurements according to ASTM C-177, the guarded hot plate provides the power (heat flow per unit time) recorded.

However, the subject-matter of claim 1 is directed towards foamed polypropylene compositions per se and not to a method claim which would require the measuring

step using ASTM C-177. At the same time, the test method according to ASTM C-177 is the more accurate one, and the precision of the comparative test method specified in ASTM C-518 cannot be higher than the one of ASTM C-177.

The ratio for the quotient $tm_{(extrusion\ direction)}/k$ determined in example 2 of the patent amounts to about 15000 MPa·mK/W. It thus exceeds the required threshold value of 9000 MPa·mK/W by far. It is thus plausible that the foamed polypropylene composition of example 2 falls within the scope of claim 1, irrespective of the test method employed for determining the k-value (i.e. ASTM C-177 or ASTM C-518).

4.2 Allegedly missing information in the patent for reproducing examples 1 and 2

4.2.1 The board notes that all the components used in examples 1 and 2 except for the physical blowing agent are identified in the examples of the patent, including the nucleating agent which also serves as a chemical blowing agent in the compositions of comparative example 1 and example 2 of the patent (see paragraphs [0069] and [0070] in combination with table 2).

4.2.2 The respondents argued that example 2 could not be reworked since the melt flow range (MFR) of the matrix polypropylene contained in the masterbatch could according to D23 vary from 1 to 40 g/10 min. This is per se no bar to the reproducibility of the example. Even assuming that the commercial masterbatch Nepol™ GB415HP would exhibit fluctuations of the MFR from batch to batch between the extremes of 1 and 40 g/10 min and that such fluctuations could influence the exact values of $tm_{(extrusion\ direction)}/k$ obtained in the

resulting foam compositions, such variations could not hinder the person skilled in the art to compound the ingredients specified in example 2 of the patent. Thus, the person skilled could on the whole rework the example. This example includes the masterbatch Nepol™ GB415HP as specified in documents D7 and D23 and paragraph [0068] of the patent.

4.2.3 While the respondents correctly mentioned by referring to Figure 7 of D9 that glass fibre length has a significant effect on the tensile modulus of polypropylene-based composites, it follows from Figure 7 that the range of from 1 to 10 mm fibre length yields higher tensile moduli than observed for shorter fibres for the fibres under scrutiny. However, this range is also the most preferred range for the glass fibre length in paragraph [0017] of the patent. The alleged criticality of the aspect ratio of the fibres for reproducing the examples of the patent has not been corroborated by the respondents with pertinent evidence. Moreover, useful glass fibre masterbatches like Nepol™ GB415HP used in the examples were commercially available at the filing date of the patent (see paragraph [0020] of the patent).

4.2.4 Likewise, the respondents objected to the indication of the brand names of the polypropylenes "Daploy™ WB130HMS" and "BorECO™ BA222E" used in the examples of the patent.

The board holds that these two polymers, designated as having a "commercial grade" in paragraphs [0066] and [0067] of the patent, are further characterised in table 1 of the patent, and the patent also describes useful impact polypropylenes and high melt strength polypropylenes in structural terms in paragraphs [0022]

to [0033]. Hence, ample information is provided in the patent on suitable polypropylenes.

4.2.5 As regards the physical blowing agent employed in examples 1 and 2, the skilled person would, when confronted with such an indication missing from the example, consult other parts of the description. It is set out in paragraph [0044] that carbon dioxide is the preferred physical blowing agent. It can thus be expected to give optimal results. There is, moreover, neither evidence at hand, nor a plausible suspicion, that using carbon dioxide as a physical blowing agent would not have led to the values obtained in examples 1 and 2.

4.2.6 The respondents also submitted that examples 1 and 2 could not be reproduced due to missing indications with regard to the conditions of measurement employed in the patent for determining the numerical k-values and the tm-values. These alleged ambiguities do not give rise to a lack of sufficiency of disclosure for the reasons set out below.

4.2.7 Claim 1 stipulates that the k-values be measured applying the ASTM C-177 standard. The resulting reading values are obtained by an absolute test method and not a relative one like ASTM C-518 (to which reference is made in paragraph [0058] of the patent). A skilled person would thus apply ASTM C-177 for obtaining more exact reading values and ASTM C-518 for a quick routine determination of k-values. Hence, even assuming that the two methods yielded non-identical results (which has not been demonstrated in this case), no insufficiency of disclosure would arise from this point (see T 492/92, point 3.3 of the Reasons).

4.2.8 The foam compositions of the patent are used for the preparation of insulating layers, in particular insulating layers for steel pipes. The layers are typically prepared by extrusion (see the examples and claim 1, which mention the tensile modulus in *extrusion direction*).

Therefore, the respondents' argument that, in analogy with D12, the k-values could be measured either in the layer direction or perpendicular to it (i.e. across the layer thickness) is not persuasive. Having in mind the application field of pipe insulation, a skilled person would have considered the thermal insulation properties across the layer thickness. Thus, it also follows from the experimental setup for determining the thermal insulation properties of the foams described in the patent that only the thermal conductivity across the layer thickness was determined. Paragraph [0060] of the patent sets out that 24 circular-shaped sheets were placed between two plates held at different temperatures. It is thus clear that the thermal conductivity coefficient was determined in the direction of the layer thickness and not in the plane of the extruded sheets. Consequently, the board disagrees with the opposition division's conclusion that there was no guidance in the patent on what direction was used when measuring the k-value.

4.2.9 The board considers that when reading paragraph [0060] with synthetical propensity, any interpretation of it that a stack of 24 sheets could have been formed, followed by cutting the stack from the side (i.e. in plane, parallel to the layer planes), is not derivable from the information provided in paragraph [0060] and would be illogical in view of the aim to provide thermal insulation tubing for pipes (from a surrounding

medium). Paragraph [0060] sets out that the sample*s* were cut into circular shapes and joined together with a pressure of 0.69 kg/cm$^2$. No stacking of the 24 samples prior to cutting is mentioned in paragraph [0060].

Even assuming that such a stacking took place prior to cutting out sample specimens perpendicularly to the planes of the individual sheets, it has not been demonstrated by the respondents that any potential glass fibre alignment in the foam layers would have resulted in a significant fluctuation of the reading values for the k-values obtained, depending on the direction of the alignment of the fibres. Such an alignment could have taken place if the allegedly stacked sheets were positioned on top of each other in the same orientation (relative to the extrusion direction), assuming that alignment of the fibres takes place during extrusion of the foam compositions.

4.2.10 The respondents also argued that it was not clear how the thickness of the test specimen of 30 mm had been obtained in the patent. An extrusion gap of 0.2 mm would not result in a stack of 24 sheets with a thickness of 30 mm.

This argument does not convince the board either. Firstly, there is no information in the patent that the extrusion gap can be equated with the thickness of the resulting foam sheets. Secondly, it is not apparent that such an alleged discrepancy would be a bar to reliably measuring the k-value of the polypropylene foams.

The respondents' argument that the pressure applied during the measurement might lead to the compression of

the foam samples and decrease the thickness during the measurement, depending on the compressibility of the foam layers, is speculative. The pressure applied to the sheets is exactly defined in paragraph [0060]. The board takes the view that a specific plate separation has to be expected for a given foam composition, resulting from the applied constraints, i.e. layer thickness and the defined, applied pressure, kept at 0.69 $kg/cm^2$.

Also, any alleged variations of the surface roughness, potentially ascribable to sample preparation and the nature of the blowing agents employed, would be no bar to the determination of the k-values of foam specimens.

4.2.11 The respondents' contention that the pressure applied to the test specimens was relatively low and most likely not sufficient to remove all air entrapped between the sheets has no apparent bearing on sufficiency of disclosure either. Even assuming that some air would be entrapped between individual layers of the test specimen (which is speculative), the measurement conditions would still be defined in view of the specified pressure of 0.69 $kg/cm^2$.

Also, the fact that neither ASTM C-518 nor ASTM C-177 mention the measurement of stacks of sheets would be no bar to the reliable determination of the k-value in view of the pertinent information provided in the patent.

Thus, the board concludes that the issues relating to the measurement of the k-value raised by the respondents at best give rise to clarity issues and not a lack of sufficiency of disclosure.

4.2.12 As regards the determination of the tensile modulus in extrusion direction, the board notes that the test specimens for the measurement of the tensile modulus of the polypropylene foams are not compression or injection moulded or machined from plates but are obtained from extrusion-moulded sheets prepared in the examples of the patent in suit. As put forward in the board's communication dated 30 June 2021, according to point 6.1 of ISO 527-2: 1993 (D17), type 1A specimens are preferred for directly moulded test specimens and type 1B specimens for machined test specimens. Even assuming that a skilled person could not unambiguously infer from the indications provided in D17 which test specimens should be employed, there is no evidence on file that the exact measurement conditions would significantly influence the obtained reading values for the tensile modulus (which would at most have a bearing on the clarity of claim 1 within the meaning of Article 84 EPC).

4.3 Additional information contained in the patent complementary to the examples

4.3.1 While the examples of the patent may not be exactly reproducible, the board takes the view that a skilled person at the filing date of the patent was able to carry out the claimed invention over the full breadth of claim 1 without undue burden in view of the additional information provided in the patent that complemented the examples.

The patent in suit comprises detailed information on types of useful polypropylene matrix polymers. In a preferred embodiment, a polymer component (A) is proposed in the patent, preferably a long-chain branched propylene homopolymer showing strain-hardening

behaviour. Furthermore, it is preferred that a polymer component (B) which is a high impact strength polypropylene, in particular a block copolymer of ethylene and propylene with an ethylene content of up to 10 wt.-%, be employed. Further specifications of preferred polypropylenes are indicated in the description in paragraphs [0022] to [0033] of the patent, including useful amounts of polypropylene components (A) and (B). Additional information on the polypropylenes used in the examples is provided in paragraphs [0066] and [0067] and table 1 of the patent. Hence, the fact that the type of polypropylene contained in the masterbatch composition Nepol™ GB415HP is not disclosed in the patent is no bar to selecting suitable polypropylenes which exhibit a high tensile modulus in the direction of extrusion in foamed compositions. The respondents had argued by referring to documents D10 and D14 that the type of polypropylenes used in foam compositions markedly influenced the mechanical properties of the foams, including their tensile moduli, and the foam structure.

The patent also features Nepol™ GB415HP as an exemplary masterbatch in paragraph [0020] of the patent. There it is mentioned that the masterbatch contains 42 wt.-% of glass fibres. The polypropylene is impregnated with the glass fibres, shaped, cooled and subsequently cut into rods of preferably approximately 1 to 10 mm. According to paragraph [0017], the average length of the glass fibres is most preferably between 1.0 and 10 mm.

Preferred physical and chemical blowing agents are described in paragraphs [0044] and [0046] of the patent. The parties dispute whether the nature of the (physical) blowing agents has a substantial impact on

the thermal conductivity and tensile moduli of the foams obtained. The respondents relied on paragraph [0097] of D1 and page 610 of D10, which supported the blowing agents having a substantial influence on the foam properties. By contrast, the appellant argued that the nature of the physical blowing agent had no significant impact on the foaming process. The board concludes that it has not been corroborated, e.g. by filing pertinent experimental evidence, that a variation of the blowing agent(s) employed in the polypropylene foam compositions would impose an undue burden on a skilled person wishing to obtain further embodiments falling within the scope of claim 1.

Hence, suitable components for the foam compositions are described in detail in the patent.

4.3.2 The introduction of the patent in suit sets out, when discussing the prior art in paragraph [0002], that dense polypropylene foams have relatively high thermal conductivity. Likewise, paragraph [0004] states that the concept of reinforcing polymeric foams by fibres was known from the prior art.

Consequently, the board holds that key factors for influencing the mechanical stiffness and thermal conductivity of polypropylene foams are described in the first paragraphs of the patent in suit to help illustrate the technical problem underlying the claimed subject-matter.

4.3.3 As a reflection of these introductory remarks in the patent, the incorporation of about 12 wt.-% of glass fibres in example 2 effects a significant improvement of the mechanical properties of the resulting foam (as reflected by an increase of the tensile modulus in

extrusion direction by 54% relative to comparative example 1, not comprising glass fibres). The foam composition of example 2 also exhibits a lower foam density and a lower k-value. The board concurs with the appellant that a skilled person would infer from a comparison between comparative example 1 and example 2 that larger amounts of blowing agents relative to the amounts of polypropylenes present in the composition are used in example 2.

4.3.4 Consequently, a skilled person would deduce from the information provided in the patent (and not in D29, which does not belong to the disclosure of the patent in suit) that the tensile modulus of polypropylene foams can be markedly increased by the addition of glass fibres and expect that the thermal conductivity of such foams would be decreased by reducing the foam density (by adjusting the amount of added blowing agent relative to the amounts of polypropylenes employed). The fact that there may be other factors also influencing the numerical values of the tensile moduli tm and k-values of the foams, as argued by the respondents, such as the type of polypropylene, does not invalidate this finding.

4.3.5 The board concludes that a skilled person would take the comparative example and the example according to the invention of the patent as a starting point for providing further embodiments falling within the scope of claim 1 as granted. The skilled person would take these examples and vary the content of added glass fibres. Starting from the composition of comparative example 1, comprising a high melt strength polypropylene and a high impact strength polypropylene, just the addition of small amounts of glass fibres would result in foam compositions exceeding the

threshold value of 9000 MPa·mK/W, as argued by the appellant in the oral proceedings before the board. Likewise, a skilled person wishing to rework the examples of the patent would consider employing the preferred physical blowing agent (carbon dioxide) mentioned in the patent in the amounts proposed in the examples as a starting point for pertinent experiments.

4.3.6 The board concludes that a skilled person wishing to carry out the claimed subject-matter over the full scope of claim 1 would vary the glass fibre content - present according to claim 1 in amounts of from 1 to 30 wt.-% of the total composition - using suitable polypropylenes, glass fibre masterbatches and blowing agents, all described in detail in the patent, in the amounts proposed in the patent.

4.3.7 The respondents correctly pointed out in the oral proceedings before the board that the quotient $tm_{(extrusion\ direction)}/k$ in polypropylene foams is mainly determined by the amount of glass fibres added (for a given polypropylene polymer matrix) and that a linear correlation between the added amount of glass fibres and the numerical values for the quotient $tm_{(extrusion\ direction)}/k$ applied.

When varying the glass fibre content in the polypropylene foams within the claimed range between 1 and 30 wt.-%, departing from comparative example 1 as the starting point and adding such glass fibres (added in the form of masterbatches), a skilled person would have inevitably arrived at the subject-matter of claim 1 essentially across the full breadth of the claim. Further variations of the used polypropylenes and other ingredients would plausibly result in additional embodiments falling within the ambit of claim 1 as

granted, as rendered plausible in view of the results obtained for the additional foam compositions described in D29 (all falling within the scope of claim 1).

4.3.8 Thus, a skilled person wishing to carry out the subject-matter of claim 1 over the full scope of the claim would have added, to polypropylene foam compositions, between 1 wt.-% and 30 w.-% of glass fibres, based on the total foam composition, to meet the parametric limitation $tm_{(extrusion\ direction)}/k \geq 9000$ MPa·mK/W.

The respondents have failed to convince the board that the steps above would involve undertaking a research programme. For these reasons, the situation differs from case T 61/14 in which the board found that the respondent had raised serious doubts in the form of plausible arguments on the lack of information in the patent in suit on key issues for carrying out the invention (see T 61/14, point 6 of the Reasons).

D8 contains a statement that inorganic fillers typically increase the thermal conductivities of polymers from a few percent to over ten times. The respondents referred to this statement in point 228 of their submission of 1 September 2021 and stressed the resulting mutually counteracting effects of glass fibre addition on the increase of tm-values and the increase of the k-values at the same time. As long as the increase of tensile modulus outweighs the increase of the numerical k-values, this finding is not detrimental to sufficiency of disclosure. This situation is encountered in the patent, as the quotient $tm_{(extrusion\ direction)}/k$ in polypropylene foams is mainly determined by the amount of glass fibres added (see point 4.3.7 above).

4.4 The experiments featured in D29 in relation to sufficiency of disclosure

4.4.1 The data provided in D29 as presented in Figure 1 of the respondents' submission of 1 September 2021 support the conclusion drawn under point 4.3.7. In addition, all the examples provided in D29 fall within the scope of claim 1 as granted.

4.4.2 However, it is likely that with the polypropylene matrix polymers employed in the experiments of D29, the threshold value of 9000 MPa·mK/W cannot be reached when adding only low amounts of glass fibres. This is plausible in view of markedly lower extrapolated tm/k values for unfilled polypropylene foams in Figure 1 (zero crossing of the straight lines at 0 wt.-% glass fibre content) relative to the numerical value of the quotient for $tm_{(extrusion\ direction)}/k$ observed for the composition of comparative example 1 of the patent. The latter comprises a blend of preferred polypropylenes as per the patent in suit. The appellant remarked that the polypropylenes employed in D29 exhibit lower tensile moduli than those preferred polypropylenes used in the examples of the patent.

4.4.3 It is, however, not necessary to attain each and every numerical value combination of $tm_{(extrusion\ direction)}$ and k-values in claim 1 to meet the requirement of sufficiency of disclosure. What counts is to provide quotient values reaching the threshold value of 9000 MPa·mK/W to provide embodiments falling within the scope of claim 1.

4.4.4 The board concludes that D29 does not support the argument that the patent taught away from achieving

$tm_{(extrusion\ direction)}/k$ quotient values of 9000 or greater. It only supports that higher amounts of glass fibres are needed when using rather short glass fibres and/or polymer matrices which are not preferred embodiments in the patent in suit.

4.5 Further arguments by the respondents

4.5.1 The respondents also objected to the open range for the relation called for in claim 1.

However, it is clear to a skilled person that there is an inherent upper limit in practice to the values attainable for the tm/k quotient. Such an inherent limit can be expected due to the constraints imposed by claim 1, including a maximum amount of glass fibres in the compositions (30 wt.-% based on the total compositions). However, where it is clear to a skilled person that an open-ended range is limited in practice, no objection of insufficiency of disclosure arises from such a constellation (see T 1943/15, point 2.5 of the Reasons).

4.5.2 The allegation put forward by the respondents in the oral proceedings before the board that it was not likely that embodiments of claim 1 having densities as low as 50 $kg/m^3$ could be obtained was not substantiated.

4.6 Conclusion on sufficiency

The board concludes that a skilled person would, starting from the examples provided in the patent in suit and in view of the additional information provided in the patent and their common general knowledge at the filing date of the patent, have been enabled to carry

out the claimed subject-matter of claim 1 over the full scope of the claim without undue burden. Consequently, the ground for opposition under Article 100(b) EPC does not prevent the maintenance of the patent as granted.

5. Remittal

Since the decision under appeal deals in particular with the requirement of sufficiency of disclosure and not with novelty and inventive step, the board considers, in line with both parties, that special reasons present themselves for remitting the case to the opposition division for further prosecution (Article 11 RPBA 2020).

**Order**

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

1. The decision under appeal is set aside.

2. The case is remitted to the opposition division for further prosecution.

The Registrar: The Chairman:

A. Nielsen-Hannerup A. Haderlein

Decision electronically authenticated