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**Datasheet for the decision
of 15 March 2024**

Case Number: T 0557/22 - 3.3.03

Application Number: 16739543.3

Publication Number: 3319543

IPC: C08F222/10, A61C7/08,
B33Y10/00, B33Y70/00

Language of the proceedings: EN

Title of invention:

DENTAL MATERIALS USING THERMOSET POLYMERS

Patent Proprietor:

Align Technology, Inc.

Opponents:

Henkel AG & Co. KGaA
Vossius & Partner
Patentanwälte Rechtsanwälte mbB

Relevant legal provisions:

RPBA 2020 Art. 12(4), 13(1)
EPC 1973 Art. 123(2), 83, 56

Keyword:

New documents submitted on appeal - no proper justification - admitted (no)

Main Request - extension of subject-matter beyond the content of the application as filed - dependent claims 2 to 5 and independent claim 10 (no)

sufficiency of disclosure - dependent claim 5 (no) dependent claim 6 (yes)

inventive step - obvious modification (yes)

Auxiliary request 1 - sufficiency of disclosure - claim 5 (no)

Auxiliary requests 1 to 11 - inventive step (no) obvious modification

Auxiliary request 12 - inventive step (yes) non obvious modification - hindsight

Decisions cited:

G 0002/10, G 0001/16, T 0939/92, T 0063/06



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Case Number: T 0557/22 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 15 March 2024

Appellant:
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Decision under appeal:

**Interlocutory decision of the Opposition
Division of the European Patent Office posted on
22 December 2021 concerning maintenance of the
European Patent No. 3319543 in amended form.**

Composition of the Board:

Chairman D. Semino
Members: F. Rousseau
 W. Ungler

Summary of Facts and Submissions

I. The appeals lie from the interlocutory decision of the opposition division according to which European patent No. 3 319 543 as amended according to the claims of the main request submitted with letter of 28 October 2020 and a description adapted thereto met the requirements of the EPC.

II. The decision was taken having regard *inter alia* to the following documentary evidence:

D1: JP 2001-310918 A and translation thereof in English
D1a

D6: WO 2014/078537 A1

D10: WO 2006/044012 A1

D11: US 2013/0078594 A1.

III. According to the reasons for the contested decision which are pertinent in the appeal proceedings:

(a) Claims 1 and 10 met the requirements of Article 123(2) EPC.

(b) Based on the information given in the specification and the common general knowledge, the skilled person would be able to prepare the crosslinked polymer of claim 1. Concerning claim 5 the objection relating to the insufficient definition of the parameter did not prevent the skilled person from preparing the claimed polymer and that ambiguity did not lead to a lack of sufficiency of disclosure.

(c) Concerning inventive step, D6 which concerned dental devices, such as orthodontics, obtained by 3D printing, using thermoset polymers represented the closest prior art. The features distinguishing the orthodontics of claim 1 of the main request from those of D6 were the mechanical properties of the crosslinked polymer defined in terms of values for the tensile modulus, the tensile strength at yield, the elongation at yield and the elongation at break. In the absence of comparative examples, the problem to be solved resided in the provision of an alternative orthodontic appliance. D10 concerned a completely different technology from that of D6, the former using a different chemistry, as it related to orthodontic appliances manufactured from conventional thermoforming materials using eventually a curing step. On that basis, starting from D6, the skilled person would not consult D10 and even if they did so, would not expect, having regard to the difference in materials and technologies between these documents, to obtain the mechanical properties described in D10. An inventive step was therefore acknowledged.

IV. An appeal was filed by opponent 2 (appellant). A second appeal filed by opponent 1 (other party) was withdrawn.

V. With their statement of grounds of appeal, the appellant filed the following additional documents:

D21: WO 2013/171124 A1

D22: US 7,210,926 B2

D23: US 8,765,031 B2

D24: Petition filed with the USPTO on 19 November 2008 by the patentee in the proceedings relating to US 7,641,828

D25: <https://asrengineering.com/2019/08/14/the-stress-strain-curve-intro-tostructural-engineering/>

- VI. The patent proprietor (respondent) replied to the statement of grounds of appeal with letter of 16 September 2022 with which sets of claims labelled auxiliary requests 1 to 58 were filed.
- VII. In reply to the rejoinder of the respondent, the appellant submitted with letter of 22 December 2022 the following documents:
- D26: A. G. H. Dietz, F. J. McGarry, "The effects of speed in the mechanical testing of plastics testing", Symposium on Speed of Testing of Non-Metallic Materials, STP185-EB/Jul. 1956
- D27: D. A. Şerban *et al*, "Tensile properties of semi-crystalline thermoplastic polymers: Effects of temperature and strain rates", Polymer Testing 32 (2013) pages 413-425
- VIII. In preparation of the oral proceedings, a communication pursuant to Article 15(1) RPBA conveying the Board's provisional opinion was issued.
- IX. In reply to the Board's communication, the appellant submitted with letter of 19 February 2024 new auxiliary requests 2 to 5 and 12 to 17.
- X. Oral proceedings before the Board were held by videoconference on 15 March 2024 in the announced absence of the other party.

XI. The final requests of the parties were as follows:

The appellant requested that the contested decision be set aside and the patent be revoked.

The respondent requested that the appeal be dismissed (main request), or, in the alternative, that the patent be maintained in amended form on the basis of any of auxiliary requests 1 to 58, whereby auxiliary requests 1, 6 to 11 and 18 to 58 were filed with the rejoinder to the statement of grounds of appeal and auxiliary requests 2 to 5 and 12 to 17 were filed with letter of 19 February 2024. Auxiliary requests 2 and 3 and 12 to 17, filed with the reply to the statement of grounds of appeal, were conditionally withdrawn, if auxiliary requests 2 and 3 and 12 to 17 filed with letter of 19 February 2024 were admitted into the proceedings.

The other party, who is party as of right to the appeal proceedings pursuant to Article 107, second sentence, EPC, did not make any request or submissions during the appeal proceedings.

XII. The claims which are relevant to the present decision are as follows:

Main request (submitted with letter of 28 October 2020)

1. An orthodontic appliance comprising a crosslinked polymer, the crosslinked polymer having a tensile modulus from 800 MPa to 2000 MPa, a tensile strength at yield of 20 MPa to 55 MPa, an elongation at yield greater than 4% and an elongation at break greater than 30%, as measured by the method disclosed in the description; wherein the crosslinked polymer comprises a first repeating unit derived from a urethane

(meth)acrylate oligomer and a second repeating unit derived from a vinyl or thiol monomer wherein at least one of the urethane (meth)acrylate oligomer, the vinyl monomer and the thiol monomer comprises at least two polymerizable groups.

2. The orthodontic appliance of claim 1, wherein the elongation at yield is greater than 4% and less than or equal to 10%.

3. The orthodontic appliance of claim 1, wherein the elongation at break is greater than 40%.

4. The orthodontic appliance of claim 3, wherein the elongation at break is greater than 40% and less than or equal to 250%.

5. The orthodontic appliance of any one of claims 1-4, wherein at 37°C and 100% relative humidity the remaining load is greater than 10% of the initial load at 24 hours.

6. The orthodontic appliance of claim 1, wherein the amount of the first repeating unit is from 25 to 50 wt% and the amount of the second repeating unit is from 50 to 75 wt%, with the total amount of the first repeating unit and the second repeating unit being greater than or equal to 70 wt%.

10. A method of making an orthodontic appliance comprising a crosslinked polymer, the method comprising: providing a light polymerizable liquid composition comprising: a first polymerizable component, wherein the first polymerizable component is a urethane (meth)acrylate oligomer; a second polymerizable component, wherein the second

polymerizable component is a vinyl monomer, or thiol monomer, and a photoinitiator; wherein at least one of the first and second polymerizable components comprises at least two polymerizable groups; and fabricating the cross-linked polymer by a direct fabrication technique; wherein the crosslinked polymer has a tensile modulus from 800 MPa to 2000 MPa, a tensile strength at yield of 20 MPa to 55 MPa, an elongation at yield greater than 4% and an elongation at break greater than 30%, as measured by the method disclosed in the description.

Auxiliary request 1 (submitted with the rejoinder)

Claim 5 has a wording identical to that of claim 5 of the main request, with claim 1 of auxiliary request 1, on which claim 5 depends, differing from claim 1 of the main request in that the crosslinked polymer is defined to be thermoset.

Auxiliary request 2 (submitted with letter of 19 February 2024)

Claim 1 corresponds to claim 1 of the main request.

Auxiliary request 3 (submitted with letter of 19 February 2024)

Claim 1 of auxiliary request 3 corresponds to claim 1 of the main request in which the crosslinked polymer is additionally defined to be thermoset.

Auxiliary request 4 (submitted with letter of 19 February 2024)

Claim 1 corresponds to claim 1 of the main request.

Auxiliary request 5 (submitted with letter of 19 February 2024)

Claim 1 corresponds to claim 1 of auxiliary request 3.

Auxiliary request 6 (submitted with the rejoinder)

Claim 1 of auxiliary request 6 corresponds to claim 1 of the main request in which the orthodontic appliance is defined to be a brace, retainer or shell aligner.

Auxiliary request 7 (submitted with the rejoinder)

Claim 1 of auxiliary request 7 corresponds to claim 1 of auxiliary request 6 in which the crosslinked polymer is additionally defined to be thermoset.

Auxiliary request 8 (submitted with the rejoinder)

Claim 1 of auxiliary request 8 corresponds to claim 1 of the main request in which it is additionally defined that "*either said vinyl monomer does not include a urethane linkage or (meth)acrylate functional groups, or said vinyl monomer is a (meth)acrylate monomer and does not include a urethane linkage*".

Auxiliary request 9 (submitted with the rejoinder)

Claim 1 of auxiliary request 9 corresponds to claim 1 of auxiliary request 8 in which the crosslinked polymer is additionally defined to be thermoset.

Auxiliary request 10 (submitted with the rejoinder)

Claim 1 of auxiliary request 10 corresponds to claim 1 of auxiliary request 8 in which the orthodontic appliance is defined to be a brace, retainer or shell aligner.

Auxiliary request 11 (submitted with the rejoinder)

Claim 1 of auxiliary request 11 corresponds to claim 1 of auxiliary request 10 in which the crosslinked polymer is additionally defined to be thermoset.

Auxiliary request 12 (submitted with letter of 19 February 2024)

Claims 1 and 6 according to auxiliary request 12 read as follows (with addition to the wording of claims 1 and 10, respectively, of the main request underlined, and deleted portions ~~struck-through~~):

"1. An orthodontic appliance comprising a crosslinked polymer, the crosslinked polymer having a tensile modulus from 800 MPa to 2000 MPa, a tensile strength at yield of 20 MPa to 55 MPa, an elongation at yield greater than 4% and an elongation at break greater than 30%, as measured by the method disclosed in the description; wherein the crosslinked polymer comprises a first repeating unit derived from a urethane (meth)acrylate oligomer, and a second repeating unit derived from a vinyl ~~or thiol~~ monomer not including a urethane linkage, and a third repeating unit derived from a thiol monomer not including a urethane linkage, wherein at least one of the urethane (meth)acrylate oligomer, the vinyl monomer and the thiol monomer comprises at least two polymerizable groups.

6. A method of making an orthodontic appliance comprising a crosslinked polymer, the method comprising: providing a light polymerizable liquid composition comprising: a first polymerizable component, wherein the first polymerizable component is a urethane (meth)acrylate oligomer; a second

polymerizable component, wherein the second polymerizable component is a vinyl monomer not including a urethane linkage, or thiol monomer, and a photoinitiator; and a third repeating unit derived from a thiol monomer not including a urethane linkage; wherein at least one of ~~the first and second polymerizable components~~ the urethane (meth)acrylate oligomer, the vinyl monomer and the thiol monomer comprises at least two polymerizable groups; and fabricating the cross-linked polymer by a direct fabrication technique; wherein the crosslinked polymer has a tensile modulus from 800 MPa to 2000 MPa, a tensile strength at yield of 20 MPa to 55 MPa, an elongation at yield greater than 4% and an elongation at break greater than 30%, as measured by the method disclosed in the description."

XIII. The parties' submissions, in so far as they are pertinent to the present decision, may be derived from the reasons for the decision below. They concerned essentially admittance of documents D21 to D27, the question whether claims 2 to 5 and 10 of the main request extended beyond the content of the application as filed, sufficiency of disclosure of the subject-matter of claims 5 and 6 of the main request and whether the subject-matter of claim 1 of any of the main and auxiliary request 2 to 12 is inventive starting from the teaching of D6.

Reasons for the Decision

Admittance of D21 to D25

1. The submission of documents D21 to D25 is to be regarded as an amendment to the appellant's appeal case within the meaning of Article 12(4) RPBA 2020 whose admittance to the proceedings is subject to the discretionary power of the Board in accordance with Article 12, paragraphs (4) to (6) RPBA 2020. According to Article 12(6) RPBA, the Board shall not admit requests, facts, objections or evidence which should have been submitted, or which were no longer maintained, in the proceedings leading to the decision under appeal, unless the circumstances of the appeal case justify their admittance.
- 1.1 According to the appellant the justification for submitting these documents on appeal would be the change of opinion of the opposition division after issuance of their preliminary opinion concerning the obviousness to apply the teaching of D10 relating to the parametric values tensile modulus, tensile strength at yield, elongation at yield, and elongation at break recited therein in the context of the closest prior art D6, although the respondent had not made any additional written submissions in relation to inventive step following the opposition division's written preliminary opinion.
- 1.2 It is undisputed that the opposition division's reasoning concerning the lack of obviousness of applying said teaching of D10 in the context of D6 was based on submissions contained in the reply to the notices of opposition and therefore known to the

appellant. Indeed the reasoning of the opposition division is to be found in sections 5.2.6 to 5.2.9 of said reply. Although those passages refer to a document D11, there is no doubt in view of the passages cited that D11 corresponds to D10 referred to in the contested decision. This is also not disputed by the appellant. The argument that a skilled person would not isolate the specific mechanical properties from D10 and expect them to be achievable by 3D printing processes is to be found in section 5.2.9 of the reply of the patentee. It does not therefore constitute "an entirely new and erroneous interpretation" of D10 as alleged by appellant.

1.3 Moreover, it is settled Case Law that provisional opinions sent in preparation for oral proceeding are not binding and that the opposition division is free to change their mind, provided that there is no violation of the right to be heard, which is not the case, as the reasoning underlying the contested decision in respect of inventive step, whether or not it was agreed by the appellant, was already known to them. Under these circumstances the appellant could and should have already submitted before the opposition division additional evidence in response to the reply to the notice of opposition, if they wished to rely thereon.

1.4 On that basis, the Board decided to make use of its discretionary power under Article 12, paragraphs (4) to (6) RPBA 2020 and not to admit D21 to D25.

Admittance of D26 and D27

2. The admittance of documents D26 and D27 submitted by the appellant after their grounds of appeal is regulated by Article 13(1) RPBA. It is subject to the

party's justification for its amendment and may be admitted only at the discretion of the Board. Article 12, paragraphs 4 to 6, RPBA 2020 shall apply *mutatis mutandis*. These documents have been submitted to counter the respondent's assertion that the values mentioned in D21 and D22 could not be taken into account because they were measured with a different crosshead speed (letter of 22 December 2022, page 5, section 2.3). Having regard to Board's decision not to admit D21 and D22, there is therefore no justification for the Board to take into account the respondent's submissions concerning their lack of pertinence, as well as D26 and D27 submitted by the appellant to rebut the respondent's submissions in this respect. In view of the criterion mentioned in Article 12(6), second sentence, RPBA the Board finds it appropriate to exercise its discretion under Article 13(1) RPBA by not admitting D26 and D27 into the proceedings.

Main request

Amendments

Claims 2 to 5

3. The appellant objects that claims 2 to 5 extend beyond the content of the application as filed, since the elongation at yield values defined in those claims are disclosed in the application as filed to relate to the crosslinked polymer, but not to the orthodontic appliance. This is not convincing, because these dependent claims must be read in the light of claim 1, according to which the elongation at yield is a parameter defining the crosslinked polymer.

Claim 10

4. At the oral proceeding the respondent did not pursue the argument put in writing that page 1, lines 28-32 of the application as filed established a link between the mechanical properties defined in claim 1 as filed and the use of a direct fabrication technique. In this respect, the appellant had correctly pointed out in writing that this passage of the brief summary of the invention merely mirrors the preamble of method claim 42 as filed, providing a mere introduction in the description of that independent method claim.

Instead the respondent argued at the oral proceedings that the claims of the application as filed comprised only one single independent claim for each of the main aspects of the application as filed, namely claim 1 concerning a crosslinked polymer, claim 26 directed to a light polymerizable liquid composition and claim 42 concerning a method of making an orthodontic appliance comprising a cross-linked polymer, said method using a light polymerizable liquid composition.

- 4.1 More specifically, as pointed out by the respondent, independent claim 1 as filed defines a crosslinked polymer defining the mechanical properties set out in operative method claim 10, whereby dependent claim 12 as filed specifies the monomers comprised in the crosslinked polymer, which definition is also present in operative claim 10.

In addition the light polymerizable liquid composition of claim 26 as filed is that provided in the method of operative claim 10. It comprises the same combination of monomers defined in dependent claim 12 as filed.

Furthermore, the method of making an orthodontic appliance comprising a crosslinked polymer in accordance with claim 42 as filed is defined to be a direct fabrication technique, as also required in operative claim 10, using a composition comprising polymerizable components whose definition encompasses those listed in independent claim 26 and dependent claim 12 as filed.

- 4.2 Based on the existence in the application as filed of only one independent claim for each of the above mentioned categories and their implicit relationship for the purpose of making an orthodontic appliance comprising a crosslinked polymer, it is therefore understood by the skilled reader that the method of independent claim 42 as filed is designed to employ the light polymerizable liquid composition of independent claim 26 with the purpose of obtaining a crosslinking polymer whose properties are those listed in independent claim 1 as filed. This results in the subject-matter of operative claim 10.

Reading these three main aspects of the application as filed in abstraction of each other would amount to an artificial reading of the technical teaching of the application as filed. The fact that those are technically linked and must be read in combination is confirmed by the reading of dependent claim 61, as submitted by the respondent, which claim associates the methods of making an orthodontic appliance by a direct fabrication technique and the crosslinked polymer according to any one of claims 1 to 25.

- 4.3 On that basis, it is concluded that the skilled person would derive the subject-matter of operative claim 10 directly and unambiguously from the application as

filed, complying with the the test referred to as "gold standard" in G 2/10 (point 4.3 of the Reasons) and confirmed in decision G 1/16. Accordingly, claim 10 does not extend beyond the content of the application as filed.

Sufficiency of disclosure

5. According to the established jurisprudence of the Boards of Appeal of the EPO a European patent complies with the requirements of sufficiency of disclosure, if a skilled person, on the basis of the information provided in the patent specification and, if necessary, using common general knowledge, is able to carry out the invention as claimed in its whole extent without undue burden, i.e. with reasonable effort. This means in relation to the appellant's objection the ability to prepare an orthodontic appliance as defined in present claims 6 and 5.

Claim 6

6. Claim 6 defines that the amount of the first and second repeating units is from 25 to 50 wt% and from 50 to 75 wt%, respectively, the total amount of the first and second repeating units being greater than or equal to 70 wt%. Arguing that the definition of said first and second repeating units with the wordings "*derived from a urethane (meth)acrylate oligomer*" and "*derived from a vinyl monomer*", respectively, would overlap, the appellant submits in essence that a skilled person would not know how to assign a given oligomeric mixture to these two categories. On that basis, the appellant submits that the weight percentages given in claim 6 are meaningless. This objection corresponds to that set out in point 5.3 of their notice of opposition.

The appellant argues in addition that no justification was offered in the contested decision as to why this objection was merely a clarity objection and did not relate to the issue of sufficiency of disclosure. It is submitted that the contested decision lacks substantiation in that respect.

6.1 This is not convincing. The appellant did not explain, neither in the notice of opposition, nor on appeal, why the alleged overlap between the above mentioned definition of the first and second repeating units would prevent the skilled person from preparing an orthodontic appliance in that zone of overlap. It is also noted that no objection of lack of sufficiency of disclosure has been raised against claim 1 whose subject-matter encompasses that of claim 6. On that basis, there is no reason to consider that the mere definition of amounts of the first and second repeating units in claim 6 would render the claimed subject-matter insufficiently disclosed. In agreement with the contested decision, the Board concludes that the appellant's objection does not go beyond the argument that the composition of the crosslinked polymer defined in claim 6 is ambiguous.

6.2 Moreover, in the absence of a proper argumentation relating to the lack of ability of the skilled person to prepare an orthodontic appliance as defined by the terms of claim 6, i.e. according to the alleged ambiguously defined subject-matter, there was no reason for the opposition division to take position on that issue. Accordingly, contrary to the appellant's view, the contested decision does not lack substantiation with respect to the issue of sufficiency of disclosure of claim 6.

Claim 5

7. Claim 5 reads "the orthodontic appliance of any one of claims 1-4, wherein at 37°C and 100% relative humidity the remaining load is greater than 10% of the initial load at 24 hours". The appellant objects that the specification does not contain any teaching concerning the measures to be taken to ensure that the orthodontic appliance has the required remaining load.

7.1 As a preliminary remark, it is noted that according to a technical meaningful reading of claim 5 the remaining load defined in that claim refers to that of the crosslinked polymer comprised in the orthodontic appliance, but not that of the orthodontic appliance. However, the appellant is correct when noting that the specification does not teach how that parametric requirement is to be achieved. The specification does not provide the skilled person, trying to prepare the crosslinked polymer used for the orthodontic appliance of claim 5, a set of instructions indicating how to select the monomers and their relative amounts in order to obtain a crosslinked polymer which fulfils the additional desideratum defined in said claim. It does not even provide a single example or comparative example on the basis of which the skilled person would gather relevant information as to how that parametric condition can be met. Evidence that this parameter was usual in the art or that suitable common general knowledge was available to the skilled person in order to fill the gap between the teaching of the specification and that which would be needed to prepare the crosslinked polymer as defined in claim 5 was also not submitted by the respondent.

7.2 The respondent submits that it is well established in the case law that the burden of proof to demonstrate that the skilled person could not have put the invention into effect is on the opponent, reference being made to section III, G.5.1.2(c) of the Case Law of the Boards of Appeal of the EPO, 10th edition 2022. It is, however, added in the first paragraph of said section that "*This is because it is generally to be presumed that a patent relates to an invention which is sufficiently disclosed. If the opponent has discharged its burden of proof and so conclusively established the facts, the patent proprietor then bears the burden of proving the counter-arguments it puts forward to refute those facts*". It is also recalled that in the context of the opposition ground of sufficiency of disclosure, the weight of the submissions required to rebut the legal presumption that the patent meets that requirement of the EPC depends on its strength (see T 63/06, point 3.3.1 of the Reasons, cited in the above mentioned section III, G.5.1.2(c) of the Case Law). A strong presumption requires more substantial submissions than a weak one.

7.3 In the present case, a weak presumption that the invention defined in claim 5 is sufficiently disclosed (and conversely a strong presumption for a lack of sufficiency of disclosure) results from the absence of any teaching in the specification relating to the measurement of said unusual parameter, the means to achieve the parametric value defined in said claim and an example meeting the condition.

Even if one agreed with the respondent that the parameter defined in claim 5 could be easily measured, this would not mean that the skilled person would be in the position to determine which steps have to be taken

in order for the crosslinked polymer to fulfil not only the parametric requirements of claim 1, but also that additional parametric condition. The respondent's argument that the specification would comprise plenty of teaching to work the invention might be valid for independent claim 1 on which claim 5 refers to. This, however, is not true for the invention defined by the terms of claim 5.

The respondent also submitted that according to established case law, a successful objection of insufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts, which was not the case, as no technical reasons had been submitted why the skilled person would not be able to achieve that parametric condition. This is not persuasive. In the present case, the serious doubts arise from the fact that no teaching at all is provided in this respect in the specification and the absence of any further indication, or evidence in this respect, as to what the skilled person would do in order to fulfil that additional condition with a reasonable amount of experimental work.

- 7.4 On that basis, the Board concludes that the subject-matter of claim 5 of the main request lacks sufficiency of disclosure. This means that the main request, as a whole, is already for this reason not allowable.

Inventive step

8. The appellant objected in addition that the subject-matter of the main request, in particular that of its claim 1 lacks an inventive step over the disclosure of D6 taken as the closest prior art.

Closest prior art and distinguishing features

8.1 The parties are in agreement that D6, which concerns orthodontic appliances produced by a direct manufacturing technique (a synonym for 3D printing), using a light polymerizable liquid composition which results in a crosslinked material, may be taken as the closest prior art (claim 1, paragraphs [0002] and [0014]). Examples of polymerizable compositions which can be used for making three-dimensional dental prosthesis in accordance with the teaching of D6 are given in its examples 10, 11 and 20. They comprise a urethane methacrylate oligomer, vinyl monomers, one of which comprises at least two polymerizable groups and a photoinitiator. They also comprise an impact modifier which enhances the impact strength and fracture toughness of the cured product (claim 1, paragraph [0014]). As pointed out by the respondent, citing paragraph [0040] of D6 *"The rubber impact modifiers particles are fully dispersed into the monomer, crosslinking agents and the rest of liquid/melted resin. Its hard shells are fully swollen and penetrated by the used monomer/oligomer while the soft cores remain relative intact so as to maintain distinct hard and soft phases and provide adequate suspension in the rest of components in composition and become a part of crosslinked and interpenetrating polymer network."*

8.2 There is also consensus that the subject-matter of claim 1 of the main request differs from the closest prior art in that the crosslinked polymer has the following properties:

- a tensile modulus from 800 MPa to 2000 MPa,
- a tensile strength at yield of 20 MPa to 55 MPa,
- an elongation at yield greater than 4%

- an elongation at break greater than 30%

no values for these properties being specified for the examples of D6.

In this respect, it is common general knowledge that the tensile modulus, the tensile strength, the elongation at yield and elongation at break are parameters determined in a tensile test, i.e. they express the behaviour of a material to which a force is applied in tension. Such test is partially explained in paragraph [0049] of the specification.

The tensile strength at yield defines for the skilled person the maximum stretching force which can be exerted on that material without the material undergoing permanent deformation when that stretching force is removed. Up to that maximum stretching force the material returns to its original dimension (the deformation is elastic), while above that maximum stretching force the deformation of the material does not return to its original dimension, a permanent and irreversible deformation taking place.

The elongation at yield describes the maximum elongation resulting from that maximum stretching force, i.e. the maximum ratio of length extension to original length before permanent deformation occurs.

The tensile modulus provides an indication of the material stiffness. It expresses the linear relationship between the ratio of force applied to the material and its elongation, i.e. before irreversible deformation takes place, when the material is elastic. The higher the tensile modulus, the stiffer the

material. The tensile modulus provides an indication about the elasticity of the material.

The elongation at break describes the elongation at which the material breaks when the stretching force is further increased beyond that maximum stretching force at which the deformation becomes irreversible.

Problem successfully solved

- 8.3 At the oral proceedings, the parties also agreed that the problem successfully solved by the subject-matter of claim 1 over the closest prior resides in the provision of a further orthodontic appliance.

Obviousness of the solution

- 8.4 It remains to be decided whether, having regard to the disclosure of D6, possibly in combination with other prior art documents or with common general knowledge, the skilled person wishing to solve the problem identified in point 8.3 above would have found the suggestion not only to select the mechanical properties recited in operative claim 1, but also know how to achieve those. The appellant referred in this regard to D6, D10, D11 and D1.
- 8.4.1 As noted by the appellant, a skilled person would gather from paragraph [0050] of D6 that the dental products described in that document should preferably have high strength, i.e. a flexural modulus of at least 1379 MPa (200 000 psi) and a flexural strength of at least 34 MPa (5 000 psi), reference being made to standard ASTM D790. The sole sensible technical reading of paragraph [0050] of D6 is that the properties are those measured on test samples of the dental material

used for the ASTM test, but not on articles made of that dental material.

In that respect, it is common general knowledge that the flexural modulus of a material represents the stiffness of that material when bended. A high flexural modulus indicates a stiffer material, whereas an elastic material will have a lower flexural modulus. Similarly, the flexural strength is known to the skilled person to define for an elastic material the maximum stress under bending before the material undergoes a permanent deformation, i.e. the limit under bending of the elastic and plastic behaviour of the material.

In the Board's opinion, the indication in paragraph [0050] of D6 of a lower limit for the flexural modulus and the flexural strength would immediately be linked by the skilled person in the field of dental positioning appliances to the necessity for those articles to withstand the mechanical constraints to which dental positioning appliances are subject during their use.

8.4.2 Moreover, as indicated in point 8.2 above, the elastic behaviour of a material is known in the art to be also determined on the basis of a tensile test, i.e. by measuring the parameters tensile modulus, tensile strength at yield and elongation at yield. Measuring the elongation at break which is also part of the determination of tensile properties is also without doubt relevant to the use of a particular material for dental positioning appliances. It is also obvious to the skilled person that the forces exerted on dental positioning appliances should not result in the material to be deformed permanently. This is therefore

valid for splints and aligners whose use is expressly taught in paragraph [0014] of D6.

- 8.4.3 Furthermore, D10 confirms that the skilled person was aware that the parameters determined in a tensile test are relevant for materials used for dental positioning appliances. According to D10 a promising approach for an orthodontic treatment is the use of elastic positioning appliances for realigning teeth, such appliances comprising a thin shell of elastic material that generally conforms to a patient's teeth, but that is slightly out of alignment with the patient's initial tooth configuration. Placement of the elastic positioner over the teeth applies controlled forces in specific locations to gradually move the teeth into the new configuration (paragraph bridging pages 1 and 2). As pointed out by the appellant, D10 does not only define the material of the shell aligner by indicating a minimum flexural modulus, but also by defining minimum requirements (i.e. values) for the tensile modulus, the tensile strength at yield, the elongation at yield and the elongation at break (claims 8 and 21).

On that basis, faced with the problem of providing further orthodontic appliances, in particular a shell aligner, the skilled person would find it obvious to search for a material for orthodontic appliances which exhibits an adequate mechanical strength as defined in terms of the parameters recited in operative claim 1.

- 8.4.4 Concerning the selection of the ranges of values defined for the four parameters set out in operative claim 1, it is not a matter of dispute that said ranges encompass values which are adequate for the preparation of shell aligners. This is shown in claims 8 and 21 of D10, which both concern a material of a shell used for

having a tensile strength at yield of greater than 41 MPa (6000 psi), an elongation at yield of greater than 4%, an elongation at break of greater than 80%, a tensile modulus and a flexural modulus both greater than 1379 MPa (200 000 psi).

The fact that the same ranges of values are defined in claims 8 and 21 for two materials having a different type of structure, i.e. in claim 8 a material resulting from annealing of a semi-crystalline material in order to increase its crystallinity and in claim 21 a material resulting from curing (crosslinking) of a curable material is an unmistakable indication for the skilled person that these ranges of values are not specific to a certain material, but generally suited for a material used for shell aligners. Claims 22 and 23 furthermore suggest that these values are valid for the preparation of a shell aligners by curing a large variety of polymeric materials such as acrylated monomers and polyurethanes, i.e. categories which encompass the materials of the closest prior art.

8.4.5 Moreover, while the range of values for the elongation at yield defined in operative claim 1 is identical to that recommended in D10 and the range of values for elongation at break of operative claim 1 fully encompasses that taught in D10, the ranges of values defined in operative claim 1 for the tensile modulus (800 MPa to 2000 MPa) and the tensile strength at yield (20 MPa to 55 MPa) encompass the minimum requirements set out in D10 for a shell aligner, namely greater than 1379 MPa and 41 MPa, respectively.

On that basis, considering that the problem successfully solved by the subject-matter of claim 1 over the closest prior merely resides in the provision

of a further orthodontic appliance, it is concluded that the skilled person starting from the closest prior art and guided by the teaching of D6 and D10 would have found it obvious to select parametric values defined in operative claim 1 insofar they overlap with the ranges taught in D10 for the fabrication of a shell aligner.

- 8.4.6 The respondent argued that it is only with the benefit of hindsight that the skilled person starting from the teaching of D6 would arrive at the subject-matter of operative claim 1. In this regard, it was submitted at the oral proceedings that nothing was said in D6 that the materials described in said document were deficient or that other mechanical parameters should be considered. It was also stressed by the respondent, as already argued before the opposition division, that the manufacturing methods used in D6 and D10 were so different that the skilled person would have had no reason to superpose the properties described in D10 on the polymeric materials described in D6 which exhibit a different structure.

This is not convincing. According to the case law of the boards of appeal, the answer to the question what a skilled person would have done in the light of the state of the art depends to a large extent on the technical result he/she has set out to achieve (see T 0939/92, reasons Nrs 2.4.2 and 2.5.3). Here, the skilled person wishing to provide a further orthodontic appliance is guided by the teaching of D6 which suggests the preparation of aligners, whose material in accordance with the general teaching emerging from D10 preferably meets certain mechanical parametric conditions which are dictated by the forces exerted on the aligners during their use and are not *per se*

associated with a certain type of material, as is explained in points 8.4.1 to 8.4.5 above.

8.4.7 The question to be answered is also whether the skilled person starting from the closest prior art would be able to prepare a crosslinked polymer material meeting the parametric definition of operative claim 1 without exercising inventive skills.

(a) As pointed out by the appellant referring to paragraph [0019] and the examples of D6, preferred compositions of D6 are based on polyurethane (meth)acrylates. This is illustrated with the polymerizable dental materials described in examples 10, 10A, 11 and 20 of that document, the urethane methacrylate oligomers being those prepared in example 1. There is no explicit teaching in D6 about the measures to be taken to achieve the flexural modulus and flexural strength taught in accordance with paragraph [0050] of that document, i.e. a flexural modulus of at least 1379 MPa and a flexural strength greater than 41 MPa (see point 8.4.4. above) so that it is implicitly considered in D6 that the skilled person would be aware of the measures necessitated to prepare a cured material having a degree of elasticity corresponding to the flexural properties disclosed in that document. It is in particular common general knowledge that the crosslinking density of a polymer can be adjusted to vary its elasticity.

It should be also taken into consideration that flexural and tensile properties are known to be related, in particular for substantially isotropic materials in which case the flexural and tensile strength/moduli should be similar. This is

reflected in paragraph [0006] of the patent in suit in which it is stated that "*The direct fabrication techniques described herein can be used to produce appliances with substantially isotropic material properties, e.g., substantially the same or similar strengths along all directions. In some embodiments, the direct fabrication approaches herein permit production of an orthodontic appliance with a strength that varies by no more than about 25%, about 20%, about 15%, about 10%, about 5%, about 1%, or about 0.5% along all directions*".

The respondent's argument that the skilled person would have no expectation of successfully generating with the direct printing technique of D6 the material having the properties described in D10, since their teachings lack compatibility in the sense that the direct technique produces a material layer by layer which is not homogeneous in structure, in contrast to the material obtained with the method of D10, is therefore rejected.

As noted by the appellant, referring to paragraph [0015] of D6, in the direct printing method of that document, part of the polymerization can take part during the shape formation, i.e. by applying successive layers, part of the polymerization being conducted after the shape formation. This, in the Board's opinion is an obvious measure for the skilled person towards the preparation of an article having a more homogeneous curing and therefore a more homogeneous structure. This is in fact the approach taken in example 2 of the contested patent (appellant's letter of

22 December 2022, page 27, first paragraph of section 3.19).

It is also undisputed that direct fabrication techniques were available to the skilled person to produce substantially isotropic material. This is implicitly reflected in paragraph [0006] of the specification.

Moreover, paragraphs [0038] and [0040] of D6 cited in sections 7.1.3 and 7.1.4 of the rejoinder suggest that the crosslinked polymeric article material obtained in D6 by a direct technique are homogeneous, their structure being described to rely on a crosslinked and interpenetrating polymer network obtained from a rubber impact modifier *"which disperses evenly and maintains a homogenous appearance in this resin/liquid"*.

On that basis, it is concluded that starting from the teaching of D6 the skilled person would be able based on the common general knowledge and a reasonable amount of experimentation to prepare a material having values for the tensile modulus and the tensile strength which are within the ranges defined in operative claim 1.

- (b) Moreover, D10 which is an application from the patent proprietor does not teach that specific technical measures on which the invention described in that document would be based would be required to form a cured polymeric material exhibiting the mechanical properties defining the materials obtained by the method of claims 21 to 23, i.e. materials obtained by irradiating, i.e. curing a large variety of curable polymeric material such as

acrylated oligomers and polyurethanes. Accordingly, D10 confirms that the skilled person would be in the position to prepare crosslinked material defined in operative claim 1.

- (c) Furthermore, as noted by the appellant in section 3.10 of their first letter of 22 December 2022, the patent in suit does not provide much information on how to achieve the mechanical properties recited in operative claim 1. The sole information in that respect is a list of formulations in tables 1 and 2 indicated to meet the parametric requirements of claim 1. Specific measures to be applied to adjust the tensile properties recited in claim 1 are not indicated.
- (d) Furthermore, as indicated by the appellant D1 concerns cast moulded and 3D printed materials having tensile properties overlapping with those defined in operative claim 1 (see paragraphs [0062], [0064] and [0065] of D1a). Reference is also made to example 5 in table 2 which exhibits properties similar to those defined in operative claim 1, the tensile strength at yield being just above the limit defined in operative claim 1. The materials of D1 are also based on urethane methacrylate oligomers and vinyl monomers (claim 1 and examples).
- (e) Consequently, in view of available evidence, the Board concludes that if the cured material of the closest prior art did not already exhibit the tensile properties recited in operative claim 1, the skilled person would be able using a reasonable amount of experimentation to modify their compositions so as to prepare a shell aligner

comprising a cured material meeting said tensile properties.

8.5 Accordingly, the subject-matter of claim 1 of the main request encompasses obvious embodiments insofar shell aligners having a crosslinked polymer comprising a first repeating unit derived from a urethane (meth)acrylate oligomer and a second repeating unit derived from a vinyl monomer having at least two polymerizable groups are concerned.

8.6 The main request is therefore not allowable, as the subject-matter of its claim 1 does not involve an inventive step, contrary to the requirements of Article 56 EPC.

Auxiliary request 1

9. The subject-matter of its claim 5 corresponds to that of claim 5 of the main request with the additional requirement that the crosslinked polymer is thermoset. This additional feature cannot overcome the lack of sufficiency found for the main request. This was accepted by the respondent at the oral proceedings.

Auxiliary request 2

10. Its claim 1 corresponds to claim 1 of the main request for which it was concluded that its subject-matter lacked an inventive step. That conclusion therefore equally applies to claim 1 auxiliary request 2.

Auxiliary request 3

11. Claim 1 of auxiliary request 3 corresponds to claim 1 of the main request in which the crosslinked polymer is

additionally defined to be thermoset. In the respondent's view this would imply a high degree of crosslinking, contrary to the materials of D10 which in their opinion are predominantly not crosslinked. Having regard to such difference in structure, the skilled person starting from D6, also dealing with thermoset polymers, would not have considered the teaching of D10 concerning a different type of polymeric material.

This amendment, however, has no impact on the reasoning given for claim 1 of the main request, as it does not introduce a further additional distinguishing feature over the closest prior art. As indicated in respect of the main request, the motivation of the skilled person to apply the teaching of D10 resides in the first place in the information concerning the tensile properties required by a material to be used for an aligner, which properties *per se* are not understood by the skilled person to be associated with a single type of polymeric material. The subject-matter of claim 1 of auxiliary request 3 is therefore not inventive either.

Auxiliary requests 4 and 5

12. Their claim 1 correspond to that of the main request and that of auxiliary request 3, respectively. Under these circumstances, claim 1 of auxiliary request 4 and claim 1 of auxiliary request 5 are bound to share the same fate as claim 1 of the main request and claim 1 of auxiliary request 3, namely that they lack an inventive step.

Auxiliary requests 6 to 11

13. The respondent stated at the oral proceedings that they had no further arguments as regards inventive step in

relation to auxiliary requests 6 to 11 in addition to those already brought forward with respect to auxiliary request 3. Compared to the main request, these auxiliary requests are restricted by defining (i) the type of orthodontic appliance which is selected from a brace, retainer or shell aligner (auxiliary requests 6, 7, 10 and 11), (ii) that the crosslinked polymer is thermoset (auxiliary requests 7, 9 and 11) and (iii) that *"either said vinyl monomer does not include a urethane linkage or (meth)acrylate functional groups, or said vinyl monomer is a (meth)acrylate monomer and does not include a urethane linkage"* (auxiliary requests 8 to 11).

- 13.1 Amendment (i) which defines the type of orthodontic appliance including shell aligners does not result in a different assessment of inventive step, because it has been concluded with respect to the main request that its claim 1 encompasses obvious embodiments insofar shell aligners are concerned.
- 13.2 For the reasons provided in relation to auxiliary request 3, amendment (ii) setting out that the crosslinked polymer is thermoset does not result in a different conclusion concerning inventive step either.
- 13.3 Concerning amendment (iii), the respondent merely submitted that the same arguments filed in support of the inventive step of the claims maintained by the opposition division were applicable (rejoinder, section 8.6.2) or that they had no arguments in this respect in addition to those already brought forward with respect to auxiliary request 3. In other words, no arguments were provided by the respondent as to how that additional feature (iii) defining the nature of the vinyl monomer would contribute to an inventive

activity. The Board has no reason to conclude that this amendment results in a different assessment of inventive step, because it can be agreed with the appellant that the polymerizable compositions of examples 10, 11 and 20 of D6 addressed in point 8.1 above also meet that additional requirement (statement of grounds of appeal, page 41, last paragraph).

14. It follows from the above that none of auxiliary requests 1 to 11 is allowable.

Auxiliary request 12

15. The subject-matter of auxiliary request 12 corresponds to that of the main request wherein the nature of the crosslinked polymer has been restricted to those comprising in addition to a first repeating unit derived from a urethane (meth)acrylate oligomer, a second repeating unit derived from a vinyl monomer not including a urethane linkage and a third repeating unit derived from a thiol monomer not including a urethane linkage.
- 15.1 The sole objection against that request is that the subject-matter of its claim 1 is not inventive starting from the disclosure of D6 (minutes of the oral proceedings before the Board).
- 15.2 It is undisputed that the above amendment results in a further distinguishing feature over the closest prior art, which does not describe a crosslinked polymer comprising said three repeating units. There is also agreement that the formulation of the problem successfully solved by the subject-matter of claim 1 over the closest prior art remains the same as for the main request, namely the provision of a further

orthodontic appliance. The solution to this problem resides in the selection of a crosslinked composition having the tensile properties and repeating units derived from the first to third components recited in operative claim 1.

15.3 It is the appellant's position that the skilled person faced with said problem would have found obvious in the light of paragraph [0020] of D11 to use a third monomer derived from thiol. This paragraph would explain that some thiol monomers can be used to reduce the tackiness of light-curable acrylic adhesives. In addition, like the compositions of D6, the compositions tested in the examples of D11 would be based on urethane acrylate oligomers. This would have given sufficient motivation to the skilled person to employ a thiol monomer in the compositions of D6. It is therefore the appellant's contention that the repeating units recited in operative claim 1 correspond to those of the adhesive described in D11.

15.4 D11 also concerns an orthodontic appliance having a shell body comprised of polymeric material and an auxiliary feature bonded to the polymeric material of the shell body with a cured product of a light-curable acrylic adhesive comprising an acrylate base material comprising multiple polymerizable acrylic functionality and a photoinitiator (claim 1).

The thiol monomer described in paragraph [0020] of D11 is an optional component of the light-curable acrylic adhesive used for bonding the auxiliary feature to the shell body. It was not submitted that this thiol monomer is one of the monomers constitutive of the polymeric material of the shell body described in D11.

It was only submitted that its use was obvious as part of the adhesive described in that document.

- 15.5 Even if to the benefit of the appellant, one acknowledged that starting from the orthodontics of D6, the skilled person would have found it obvious in the light of D11 to bond an auxiliary feature to the shell aligner of D6 using an adhesive in accordance with the teaching of D11 which comprises a thiol monomer, one would still not arrive at the subject-matter of operative claim 1. This would require that the crosslinked (cured) adhesive composition comprising the three repeating units defined in operative claim 1, i.e. including the thiol monomer, meets in addition the tensile properties recited in this claim.

There is, however, no compelling reason why the skilled person would have found it obvious to select tensile properties for the crosslinked (cured) adhesive which are the same as those suggested by D10 for the material of an aligner, which are necessitated in order to sustain the forces needed to gradually move teeth into a new configuration. This is because these forces are understood to be preliminary resulting from the application of the shell body, but not of that of the adhesive. On that basis, whereas the selection of these tensile properties is obvious for the skilled person when selecting a material for the shell aligner, as shown in respect of the main request, this does not hold true for the selection of an adhesive intended to be applied on the shell aligner for bonding an auxiliary feature.

On that basis, it is only with hindsight that one could conclude that D11 suggests in an obvious manner a solution to the problem posed in point 15.2 above. It

is therefore concluded that the subject-matter of claim 1 of auxiliary request 12 involves an inventive step within the meaning of Article 56 EPC.

15.6 In the absence of further objections, it is concluded that auxiliary request 12 is allowable.

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 with the order to maintain the patent with the claims of auxiliary request 12 filed with letter of 19 February 2024 after any necessary consequential amendments of the description.

The Registrar:

The Chairman:



A. Pinna

D. Semino

Decision electronically authenticated