

# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

## PCT

### NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(PCT Rule 71.1)

To:

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Date of mailing  
(day/month/year)

19.02.2025

Applicant's or agent's file reference  
P086348WO

#### IMPORTANT NOTIFICATION

International application No.  
PCT/EP2023/083202

International filing date (day/month/year)  
27.11.2023

Priority date (day/month/year)  
25.11.2022

Applicant  
Sun Chemical B.V.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international  
preliminary examining authority:



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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          |                                                                                                                                                                          |                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Applicant's or agent's file reference<br>P086348WO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>FOR FURTHER ACTION</b>                                |                                                                                                                                                                          | See Form PCT/IPEA/416 |
| International application No.<br>PCT/EP2023/083202                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | International filing date (day/month/year)<br>27.11.2023 | Priority date (day/month/year)<br>25.11.2022                                                                                                                             |                       |
| International Patent Classification (IPC) or national classification and IPC<br>INV. B32B27/32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                                                                                                                                                                          |                       |
| Applicant<br>Sun Chemical B.V.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |                                                                                                                                                                          |                       |
| <p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> a total of <u>14</u> sheets, as follows:</p> <p style="margin-left: 20px;"><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 20px;"><input type="checkbox"/> sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).</p> <p style="margin-left: 20px;"><input type="checkbox"/> superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).</p> <p>b. <input type="checkbox"/> a separate electronic file containing a sequence listing (<i>sent to the International Bureau only</i>)</p> |                                                          |                                                                                                                                                                          |                       |
| <p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |                                                                                                                                                                          |                       |
| Date of submission of the demand<br><br>05.06.2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          | Date of completion of this report<br><br>19.02.2025                                                                                                                      |                       |
| Name and mailing address of the international preliminary examining authority:<br> European Patent Office<br>D-80298 Munich<br>Tel. +49 89 2399 - 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          | Authorized officer<br><br>Stefaniu, Cristina<br><br>Telephone No. +49 89 2399-1062  |                       |

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on
- ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3(a) and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4(a))
    - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))
2. With regard to the **elements\*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

**Description, Pages**

1-38 as originally filed

**Claims, Numbers**

1-46 filed with the letter of

24-07-2024

- ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
5. ☐ This report has been established:
- ☐ taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
  - ☐ without taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/EP2023/083202

6. ☒ With regard to top-up searches (Rules 66.1 *ter* and 70.2(f)):
- ☐ A top-up search was carried out by this Authority on (all discovered documents are listed in the Supplemental Box Relating to Top-up Search).
  - ☐ Additional relevant documents have been discovered during the top-up search.
  - ☒ No top-up search was carried out by this Authority because it would serve no useful purpose.
7. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

\* If item 4 applies, some or all of those sheets may be marked "superseded".

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

|                               |             |             |
|-------------------------------|-------------|-------------|
| Novelty (N)                   | Yes: Claims | <u>1-46</u> |
|                               | No: Claims  |             |
| Inventive step (IS)           | Yes: Claims | <u>1-46</u> |
|                               | No: Claims  |             |
| Industrial applicability (IA) | Yes: Claims | <u>1-46</u> |
|                               | No: Claims  |             |

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1 JP 3 900441 B2 (FULLER H B LICENSING FINANC) 4 April 2007 (2007-04-04)
- D2 EP 3 176 196 A1 (SOCIETA' AZIONARIA PER L'INDUSTRIA CHIMICA ITALIANA S A P I C I SPA [I] 7 June 2017 (2017-06-07) cited in the application
- D3 JP 2010 059362 A (MITSUI CHEMICALS POLYURETHANES) 18 March 2010 (2010-03-18)

The applicant's arguments, submitted in the letter of 24.07.2024, have been carefully considered. Consequently, this Authority considers that the present application does meet the criteria of Article 33(1) PCT, due to the fact that the subject-matter of claims 1 - 46 seems to be novel and inventive in view of Articles 33(2) and 33(3) PCT and in view of the cited documents. The justification is given below.

**2. NOVELTY (Article 33(2) PCT)**

**2.1** Document **D1** discloses (see D1, pages 1, 2, claims 1, 6-7 and 9-10, par. 0001-0006, 0011-0013; pages 4-7, par. 0019, 0022-23, 0032-41, ex. 1-4) a solvent-free, lamination adhesive kit comprising:

a) a composition comprising:

i) an isocyanate-functionalized, polyurethane prepolymer comprising monomeric units derived from isocyanate monomers; indeed, D1 discloses the use of TDI in the inventive examples and, in claim 7, the possible use of aliphatic polyisocyanates.

Said prepolymer of D1 has an NCO content from 5 to 10 wt.%, is obtained from one or more polyether polyols, such as polypropylene glycol and TDI, and has a residual isocyanate monomer below 0.1 mass %; and

b) a polyol crosslinker, such as Rucoflex XF-5752-65, which is a polyester polyol based on: adipic acid, isophthalic acid, glycerol, 1, 6-hexanediol, and neopentyl glycol.

D1 discloses also that said composition has not more than 25000 mPa·s initial viscosity at 25°C ± 5°C and the adhesive is useful for providing durable laminated packages.

D1 fails to disclose that:

- the isocyanate-functionalised polyurethane prepolymer is aliphatic (in the specific definition given by the present application, namely, that the identity of the isocyanate alone dictates the polyurethane as being aliphatic or aromatic, and wherein an aliphatic isocyanate monomer is one wherein the isocyanate group(s) is/are not directly attached to an aromatic ring), wherein the aliphatic isocyanate monomers are diisocyanates selected from: hexamethylene diisocyanate, isophorone diisocyanate, methylene dicyclohexyl diisocyanate, xylylene diisocyanate, tetramethylxylylene diisocyanate, pentamethylene diisocyanate, and combinations thereof;
- a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof.

Thus, the subject-matter of claim 1 (and consequently that of claims 2-46) seems to be novel in view of D1.

**2.2** Document **D2** discloses (see D2, page 2, par. 0007; pages 4-8, par. 0048, 0072-74 and 0078-79, ex. 1, 3 and par. 0082-86, table 1, ex. A1, A3-A4; page 9, table 2 and claims 1-4) a solvent-free, lamination adhesive kit comprising:

a) a composition comprising:

i) an isocyanate-functionalized, polyurethane prepolymer (NCO value of 10.5%, see ex. 1) which is obtained from:

- one or more polyether polyols, such as PEG 400 (OH-terminated polyethylene glycol with 2 functional groups and Mw 400 g/mol);
- one or more polyisocyanates, such as TDI (D2 discloses also in claim 2 the possible use of: 1,3- or 1,4-isophorone diisocyanate (IPDI), 1,6-hexane diisocyanate (HDI) or xylylene diisocyanate (XDI));

and this prepolymer has a residual isocyanate monomer below 0.1 mass %; and

ii) a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers (such as: POLURENE MT100LLV (polyisocyanate HDI trimer) – see D2, ex. 3) or aliphatic polyisocyanate allophanates (such as: Tolonate XFLO100 (polyisocyanate HDI allophanate) - see D2, ex. 4).

D2 discloses that the adhesive is used for providing laminates, such as: PET-ALU/PE or PET-ALU/PPP, which are dedicated to flexible packaging for the food packaging industry.

Thus, D2 fails to disclose the presence in the composition of the lamination adhesive kit of:

b) a polyol crosslinker, wherein the polyol crosslinker is a linear or branched polyetherpolyol and/or a linear or branched polyester polyol and

- i. the use of an aliphatic prepolymer as component (i); this is suggested, yet it will be considered as a 1<sup>st</sup> selection since the inventive examples are using aromatic prepolymers, based on TDI.

Thus, the subject-matter of claim 1 (and consequently that of claims 2-46) seems to be novel in view of D2.

**2.3** Document **D3** discloses (see D3, page 3, par. 0005 ; pages 13-18, ex.1, 4, par. 0067, 0070-71, 0073, the polyisocyanate component 1; par. 0077, the polyol component 1; par. 0085, 0089 ; table 1, ex. 1 ; claims 1-10)

a solvent-free, lamination adhesive kit comprising:

a) a composition comprising:

i) an isocyanate-functionalised, aliphatic polyurethane prepolymer comprising monomeric units derived from aliphatic isocyanate monomers, wherein the aliphatic isocyanate monomers are xylylene diisocyanate; indeed, **D3** discloses a prepolymer A prepared from xylylene diisocyanate and a Polyester diol A (synthesized from: isophthalic acid, 1,3- butanediol, neopentylglycol, adipic acid and sebacic acid);

wherein the amount of free isocyanate monomer present in the polyurethane prepolymer is equal to 0.1% (w/w) of said prepolymer A. Indeed, D3 discloses that thin film distillation was used for removing unreacted xylylene diisocyanate until a value of 0.1% (w/w), and

ii) in D3, said prepolymer A is used together with an allophanate modified hexamethylene diisocyanate for obtaining a polyisocyanate component 1.

b) a polyol crosslinker, such as the polyol component 1 (obtained from the Polyester diol A, trimethylol propane and xylylene diisocyanates) which has: an average functional group of 2.5, a hydroxyl equivalent value of 196, and an acid value of 0.96.

**D3** discloses (see D3, page 16, par. 0085, 0089) that said two-pack non-solvent type-adhesive was used for the preparation of lamination composite films by using a non-solvent laminator for nylon / non-expanded polyethylene film (lamination speed: 180 m/min and coating amount: about 2.5 g/m<sup>2</sup>). A bag (which is synonym to a pouch) was produced in D3. The said composition showed good adhesive and heat seal (HS) strength (see D3, table 1, ex. 1).

Thus, D3 fails to disclose the presence in the composition of the lamination adhesive kit of:

- b) a polyol crosslinker, wherein the polyol crosslinker is a linear or branched polyetherpolyol and/or a linear or branched polyester polyol (the polyol component 1 of D3 is a OH-functional polyurethane which contains polyester diol units) and
- that the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates.

Thus, the subject-matter of claim 1 (and consequently that of claims 2-46) seems to be novel in view of D3.

### **3. INVENTIVE STEP** (Article 33(3) PCT)

#### **3.1** Closest prior art

Considering the above mentioned, **D3** is considered to be the closest prior art.

#### **3.2** Distinguishing feature: a solvent-free, lamination adhesive kit comprising:

- b) a polyol crosslinker, wherein the polyol crosslinker is a linear or branched polyetherpolyol and/or a linear or branched polyester polyol (the polyol component 1 of D3 is a OH-functional polyurethane which contains polyester diol units) and
- a polyol crosslinker which does not comprise a silane additive capable of reacting with isocyanates.

#### **3.3** Effect of the difference

The inventors were surprised to discover that adhesives obtained from the kit of the invention perform well under retort conditions even in the absence of silane additives. In particular, the tested samples of the invention do not comprise a silane additive and survived both low and high retort processes, keeping their aspect and integrity, while also displaying adequate bond strength. This is advantageous, as silane additives such as epoxy/glycidyl silanes are toxic compounds and present a hazard to health.

Moreover, the inventors found that the adhesives of the invention performed well even on metal substrates under pasteurisation testing. This is a surprising discovery, as it is common in the art to include such a silane adhesion promoter into the polyol crosslinkers when preparing adhesives for metal or metallized substrates (see, e.g., page 22, lines 19 to 27 of the application as filed), which are typically harder to adhere to. Indeed, the specific examples of the invention, which do not comprise a silane adhesion promotor, adhered well to aluminium substrates being held at 95 °C for 1 hour.

**3.4** Thus, the objective technical problem to be solved by the present invention is to provide an adhesive kit that performs well under retort conditions but does not comprise a silane additive capable of reacting with isocyanates. The solution to the problem is to use the adhesive kit of the invention.

**3.5** Why is it inventive

The skilled person would have found no suggestion in D3 that the disclosed compositions are suitable for retort applications. Thus, any suggestion that the skilled person would have modified the disclosed D3 compositions with a reasonable expectation of providing adhesives suitable for retort applications would employ impermissible hindsight knowledge of the invention.

D3 teaches the skilled person that a silane additive, such as an epoxy or amino silane, should be included in the disclosed compositions to act as a “coupling agent” (see D3, e.g., paragraphs [0047] and [0051]). As discussed, all D3 examples comprise a combination of epoxy and aminosilane and there is no suggestion in D3 that removing the silane additive from the D3 compositions would even maintain the reported adhesive properties and certainly no suggestion that the adhesives afforded would perform suitably under retort conditions. Accordingly, the skilled person would not have removed the silane additive from the D3 compositions.

Thus, there is no suggestion in D3 that the silane additive could be removed and that the polyol component could be changed to a non-urethane polyester polyol, and yet still provide an adhesive that adheres to metal substrates and can withstand pasteurisation conditions.

Furthermore, the solution to the above problem cannot be seen as obvious on the basis of the common technical knowledge or by combining the teachings of D3 with D1 or D2.

**3.6** For these reasons the subject-matter of claim 1 (and implicitly that of claims 2-46) is considered to involve an inventive step in the sense of Article 33(3) PCT.

**4.** The present application satisfies the criterion set forth in Article 33(4) PCT due to the fact that the subject matter of claims 1-46 is industrially applicable.

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## Electronically submitted

Your Ref PCT/EP2023/083202  
Our Ref P086348WO  
Date 24th July 2024

**Re: International Patent Application No. PCT/EP2023/083202  
SUN CHEMICAL B.V.**

I refer to the communication from the EPO dated 27th June 2024.

I enclose an amended set of claims to replace the claims presently on file. For information, I also enclose a copy of the amended claims with the amendments marked relative to the claims presently on file.

## Amendments

Claim 1 has been amended to include the subject matter of claim 8 as filed to recite that the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from a polyester polyol and/or a polyether polyol.

Claim 1 has been further amended to include subject matter from claim 18 as filed to recite that the polyol crosslinker is a linear or branched polyether polyol or a linear or branched polyester polyol. Former claim 18 has been amended for consistency with amended claim 1.

Claim 1 has been further amended to include the subject matter of former claims 25 and 26 to recite that the polyurethane prepolymer of part a) is incorporated into a composition comprising a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof.

Claim 1 has been further amended to include the subject matter for former claim 24 to recite that the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates. Further basis for the amendment can be found on page 22, lines 23 to 27 of the application as filed.

Claim 1 has been further amended to recite that an aliphatic polyurethane prepolymer is formed from aliphatic isocyanates wherein the identity of the isocyanate alone dictates the polyurethane as being aliphatic or aromatic. Claim 1 has been further amended to recite that an aliphatic isocyanate is one wherein the isocyanate group(s) is/are not directly attached to an aromatic ring. Basis for the amendment can be found on page 6, lines 17 to 18 and 27.

Claim 1 has been further amended to include subject matter from former claim 17 to recite that the molar ratio of the NCO groups of the aliphatic isocyanate monomers to the HO groups of the polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is from 5:1 to 2:1. Former claim 17 has been amended for consistency with amended claim 1.

Former claim 37 (present claim 33) has been amended for consistency with amended claim 1.

Former claims 8 and 24 to 26 have been deleted.

The remaining claims have been renumbered and amended for consistency with amended claim 1.

For the avoidance of doubt, no subject matter is being abandoned in any amendment of this application.

## **Clarity**

Merely to expedite prosecution, claim 1 has been amended in accordance with the examiner's request to define both aliphatic polyurethanes and aliphatic isocyanates. The examiner's objection under point 3 of the WO-ISA is not relevant to the amended claims.

Moreover, also merely to expedite prosecution, the claims have been amended to further define the components of the kit of the invention. In particular, the amended claims require that:

- i) the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from a polyester polyol and/or a polyether polyol;
- ii) the kit comprises a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof;
- iii) the polyol crosslinker is a linear or branched polyether polyol and/or a linear or branched polyester polyol.

Regarding limitation i) – the amended claims require that the polyurethane prepolymer is derived from a list of specific aliphatic diisocyanates that are reacted with a polyester and/or polyether polyol. The examples demonstrate how an aliphatic diisocyanate selected from the list recited in claim 1 can be reacted with a polyester polyol to afford a polyurethane prepolymer for use in the invention. The examples also show how this polyester polyol can be derived from a combination of different polyols and polyacids. There is no reason to anticipate that the invention could not be worked with

polyurethane prepolymers afforded from the other aliphatic diisocyanates recited in claim 1 and/or from a polyether polyol.

Regarding limitation ii) - the amended claims require that the kit of the invention comprises a further isocyanate selected from the list recited. The examples demonstrate that the kit of the invention can be worked with an aliphatic polyisocyanate trimer (HDI). There is no reason to anticipate that the invention could not be worked with the other further polyisocyanates recited in amended claim 1.

Regarding limitation iii) - the examples demonstrate that a variety of different polyester and polyol crosslinkers can be used, with each different combination providing the associated advantages. Accordingly, this feature of the claims has been limited to cover the exemplified embodiments.

The EPO's *Guidelines* (F-IV, 4.5.3) state that *"it is not necessary to include all details of the invention in the independent claim. Thus, a certain degree of generalisation of the claimed features may be permitted, provided that the claimed generalised features as a whole allow the problem to be solved. In this case a more specific definition of the features is not required"*. For the reasons discussed, the amended claims define subject matter that is a reasonable generalisation of the examples.

The claims are clear and supported by the description.

## Novelty

### D2

The claims require a kit comprising an isocyanate functionalised polyurethane prepolymer and a **polyol crosslinker**. The polyol crosslinker initiates curing of the polyurethane prepolymer. D2 **does not disclose** an adhesive composition comprising a polyol crosslinker as required by the claims. The subject matter of the claims is novel over D2 for at least this reason.

If the examiner intends to maintain an objection in view of D2, it is requested that they identify where in D2 it discloses an adhesive kit comprising an isocyanate-functionalised polyurethane prepolymer **and a polyol crosslinker**.

### D1

Claim 1 requires that the polyurethane prepolymer is derived from hexamethylene diisocyanate, isophorone diisocyanate, methylene dicyclohexyl diisocyanate, xylylene diisocyanate, tetramethylxylylene diisocyanate, pentamethylene diisocyanate, and combinations thereof. As stated in the demand, D1 at least **does not disclose** an isocyanate-functionalised, aliphatic polyurethane prepolymer derived from the specific aliphatic isocyanate monomers required by the claims on file. The examiner highlights that D1 discloses generic "aliphatic isocyanates".

The examiner must surely be aware of EPO's *Guidelines* stating that a generic disclosure **cannot take away the novelty** of a claim to the specific.<sup>1</sup> Accordingly, even if it is possible to combine the

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<sup>1</sup> EPO Guidelines, G-VI, 4.

disclosure of a specific example with a general description of the invention, which we contest,<sup>2</sup> D1 would **still not be prejudicial to the novelty** of the claimed subject matter. As discussed, D1 discloses **generic** “aliphatic polyisocyanates”, which cannot be relevant to the novelty of claims requiring **specific** aliphatic diisocyanates.

The examiner’s allegation that claim 1 lacks novelty because “*it is common knowledge that linear aliphatic isocyanates are hexamethylene diisocyanate (HDI) and pentamethylene diisocyanate*”. is **entirely inconsistent with the assessment of novelty at the EPO**, as established by G2/10 and the “Gold Standard”, which requires that subject is directly and unambiguously derivable. An assertion from the examiner that undisclosed compounds falling under a generic disclosure in the prior art are “*common knowledge*” simply does not meet the requirements of G2/10.

If the examiner maintains this objection, then it is requested that they identify **where D1 directly and unambiguously discloses an aliphatic polyurethane prepolymer derived from the aliphatic isocyanate monomers required by the claims on file**.<sup>3</sup> Otherwise, it is requested that the novelty objection be withdrawn.

For completeness, the amended claims further require that the polyurethane prepolymer is incorporated into a composition further comprising a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof. D1 also does not disclose an adhesive kit comprising a further aliphatic polyisocyanate as required by the amended claims.

The subject matter of amended claim 1 is novel over D1 for this reason also.

D3

The examiner cites a new document (D3).<sup>4</sup> The amended claims require that the molar ratio of the NCO groups of the aliphatic isocyanate monomers to the HO groups of the polyol (which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived) is from 5:1 to 2:1 and that the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates.

D3 does not disclose an adhesive kit satisfying the requirements of the amended claims.

The subject matter of the amended claims is novel.

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<sup>2</sup> The examiner continues to allege that a component of a specific D1 examples can be exchanged for an alternative component recited in the description of D1, and form the basis for an objection to lack of novelty. However, this is inconsistent with the EPO’s assessment of novelty (see, Case Law of the Boards of Appeal, I, C, 4.2). The examiner is referred to the arguments submitted in the demand.

<sup>3</sup> I.e., where in D1 does it disclose hexamethylene diisocyanate, isophorone diisocyanate, methylene dicyclohexyl diisocyanate, xylylene diisocyanate, tetramethylxylylene diisocyanate, pentamethylene diisocyanate, or combinations thereof.

<sup>4</sup> D3 was neither cited in the International Search Report nor in the search report for the EP priority application. For completeness, an EP priority application was filed in this instance in order to benefit from an EPO search and an assessment of the prior art prior to filing a PCT application. Thus, it would have been helpful if D3 was cited in the search report for the EP priority application (i.e., before the PCT application was filed) and not after the PCT was filed. The claims as filed with this PCT are largely the same as those filed with the EP priority application.

## Inventive Step

The examiner has not indicated which of the cited prior art documents is the closest prior art. Nevertheless, the skilled person would not have arrived at the present invention starting from any of the cited prior art documents.

For the sake of argument, D3 could be considered closest prior art.

The skilled person starting from D3 would have selected to start from the specific D3 examples, as these are defined embodiments of the invention (i.e., the skilled person is not required to fill in any informational gaps in the disclosure) and have been tested and found to have demonstrable adhesive properties (under the testing conditions employed).

**All** D3 examples comprise a silane additive capable of reacting with isocyanates (i.e., a combination of  $\gamma$ -glycidoxy propyl triethoxysilane and 3-aminopropyl triethoxysilane), which is incorporated into the polyol crosslinker composition. As discussed in the application, adhesive compositions of the art typically comprise silane additives to promote isocyanate reactivity as well as substrate adhesion.

The amended claims require that the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates (e.g., glycidyl and/or aminosilanes). The inventors were surprised to discover that adhesives afforded from the kit of the invention perform well under retort conditions even in the absence of silane additives.<sup>5</sup> In particular, the tested samples of the invention do not comprise a silane additive and survived both low and high retort processes, keeping their aspect and integrity, while also displaying adequate bond strength.<sup>6</sup> This is advantageous, as silane additives such as epoxy/glycidyl silanes are toxic compounds and present a hazard to health.

Moreover, the inventors found that the adhesives of the invention performed well even on metal substrates under pasteurisation testing. This is a surprising discovery, as it is common in the art to include such a silane adhesion promoter into the polyol crosslinkers when preparing adhesives for metal or metallized substrates (see, e.g., page 22, lines 19 to 27 of the application as filed), which are typically harder to adhere to. Indeed, the specific examples of the invention, which do not comprise a silane adhesion promoter, adhered well to aluminium substrates being held at 95 °C for 1 hour.<sup>7</sup>

An objective technical problem may therefore be formulated as the provision of an adhesive kit that performs well under retort conditions but does not comprise a silane additive capable of reacting with isocyanates. The solution to the problem is to use the adhesive kit of the invention.

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<sup>5</sup> See page 22, lines 23 to 27 of the application as filed.

<sup>6</sup> See Table 3 on page 32 of the application as filed as well as page 33, lines 8-10 of the application as filed. The tested examples of the invention (samples 3 to 6) are derived from the polyurethane precursor of example 3, combined with a variety of different polyol crosslinkers.

<sup>7</sup> See Table 3 on page 32 of the application as filed.

*The skilled person would not have arrived at the invention starting from D3.*

Firstly, D3 does not mention retort packaging and is therefore silent on the potential use of the disclosed adhesives in retort applications. Accordingly, D3 does not test any of the disclosed adhesives to assess their performance under retort conditions (i.e., heating at temperatures of at least 100 °C and under pressures of 1.5 to 2.6 bar). Instead, D3 merely assesses the properties of the adhesives at either room temperature or 55 °C and at atmospheric pressure (see Table 1 and paragraph [0089]).

The skilled person would have found no suggestion in D3 that the disclosed compositions are suitable for retort applications. Thus, any suggestion that the skilled person would have modified the disclosed D3 compositions with a reasonable expectation of providing adhesives suitable for retort applications would employ impermissible hindsight knowledge of the invention.

Secondly, D3 teaches the skilled person that a silane additive, such as an epoxy or amino silane, should be included in the disclosed compositions to act as a “coupling agent” (see D3, e.g., paragraphs [0047] and [0051]). As discussed, **all** D3 examples comprise a combination of epoxy and aminosilane and there is no suggestion in D3 that removing the silane additive from the D3 compositions would even maintain the reported adhesive properties and certainly no suggestion that the adhesives afforded would perform suitably under retort conditions. Accordingly, the skilled person would not have removed the silane additive from the D3 compositions.

Thirdly, D3 is directed towards adhesives for metal substrates, including those undergoing pasteurisation (see D3, e.g., paragraph [0002]). As explained, the skilled person is aware of the need for silane additives when preparing adhesives for metal substrates. There is simply no suggestion in D3 that the silane additive could be removed and yet still provide an adhesive that adheres to metal substrates and can withstand pasteurisation conditions.

For at least these reasons, the subject matter of the amended claims is inventive over D3.

*The skilled person would also not have arrived at the claimed subject matter starting from D1.*

As discussed under *Novelty*, D1 does not directly and unambiguously disclose a composition satisfying the requirements of the claims.

Similar to D3, the skilled person would have started from the D1 examples, as they are defined embodiments of the D1 invention (i.e., the skilled person is not required to fill in any informational gaps in the disclosure) and have been tested and found to have demonstrable adhesive properties (under the testing conditions employed). The specific D1 examples do not comprise a polyurethane prepolymer derived from one of the aliphatic isocyanates required by claim 1 but instead comprise a polyurethane prepolymer derived from toluene diisocyanate (an aromatic isocyanate).

The examiner is referred to the arguments submitted in the demand for international preliminary examination. In particular, D1 is not directed to retort applications and thus does not test the disclosed compositions to assess their properties under retort conditions. Moreover, D1 teaches the skilled person that the disclosed polyurethane prepolymers are preferably derived from aromatic

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isocyanates, and discloses only a single specific isocyanate for use in the D1 compositions (the aromatic toluene diisocyanate), which is incorporated into all D1 examples.

The skilled person starting from D1 would have found no motivation to modify the D1 compositions to exchange a preferred component (the aromatic toluene isocyanate) for a non-preferred component (an aliphatic isocyanate) and certainly no motivation to select one of the specific aliphatic isocyanates required by claim 1. Moreover, the skilled person would not have made this modification with a reasonable expectation of providing an adhesive with improved laminate bond strength under retort conditions.

Furthermore, amended claim 1 requires that the polyurethane prepolymer is incorporated into a composition comprising a further aliphatic isocyanate selected from aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof. There is no disclosure in D1 of any of the specific further aliphatic isocyanates required by amended claim 1. As discussed, the skilled person would not have been motivated to exchange the preferred aromatic toluene isocyanate for a non-preferred aliphatic isocyanate when forming the polyurethane prepolymer. The skilled person would also not have been motivated to introduce one of the further aliphatic isocyanates, as required by amended claim 1, for which there is no disclosure or suggestion in D1.

For completeness, the skilled person would not have consulted D2, which is directed to one-pack adhesives (i.e., adhesives that do not comprise an additional polyol crosslinker). The skilled person would have instead started from one of the citations directed towards two-pack adhesives (i.e., D1 or D3). The examiner is also referred to the arguments submitted in view of D2 in the demand for preliminary examination.

The subject matter of the amended claims is inventive.

## **Final Remarks**

The amended claims are in order for allowance.

Yours faithfully,

// ELECTRONICALLY SIGNED AND SUBMITTED //

COCKERTON, Bruce Roger

Carpmaels & Ransford LLP Professional Association No. 182

Encl. Amended claims (clean and tracked)

## CLAIMS

1. A solvent-free, lamination adhesive kit comprising:

a) a composition comprising:

i) an isocyanate-functionalised, aliphatic polyurethane prepolymer comprising monomeric units derived from aliphatic isocyanate monomers, wherein an aliphatic polyurethane prepolymer is formed from aliphatic isocyanate monomers, wherein the identity of the isocyanate alone dictates the polyurethane as being aliphatic or aromatic, and wherein an aliphatic isocyanate monomer is one wherein the isocyanate group(s) is/are not directly attached to an aromatic ring; wherein the aliphatic isocyanate monomers are diisocyanates selected from the group consisting of hexamethylene diisocyanate, isophorone diisocyanate, methylene dicyclohexyl diisocyanate, xylylene diisocyanate, tetramethylxylylene diisocyanate, pentamethylene diisocyanate, and combinations thereof; wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from a polyester polyol and/or a polyether polyol; wherein the molar ratio of the NCO groups of the aliphatic isocyanate monomers to the HO groups of the polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is from 5:1 to 2:1; and

ii) a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof; and

b) a polyol crosslinker, wherein the polyol crosslinker is a linear or branched polyether polyol and/or a linear or branched polyester polyol;

wherein the amount of free isocyanate monomer present in the polyurethane prepolymer is less than or equal to 0.1% (w/w) of said prepolymer; wherein the amount of free isocyanate monomer is determined according to the method described in the description; and wherein the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates.

2. The kit of claim 1, wherein the aliphatic isocyanate monomers are diisocyanates selected from the group consisting of isophorone diisocyanate, 1,6-hexane diisocyanate, xylylene diisocyanate, and combinations thereof, such as wherein the aliphatic isocyanate monomers are xylylene diisocyanate.

3. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is difunctionalised with isocyanate groups, optionally wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is linear and functionalised with an isocyanate group at each terminus.

4. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer has a viscosity at 80 °C of 800 mPa to 20,000 mPas, such as 1,000 mPas to 10,000 mPas, or 2,000 mPas to 7,000 mPas; wherein the viscosity is measured according to the method described in the description.

5. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer has an isocyanate group content (%NCO) of 3% to 16%, such as 5% to 10%.

6. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from equal to or greater than 95mol% aliphatic isocyanate monomers, relative to the total isocyanate monomers incorporated into the prepolymer.

7. The kit of any preceding claim, wherein the only isocyanate monomers incorporated into the isocyanate-functionalised, aliphatic polyurethane prepolymer are aliphatic isocyanate monomers.

8. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from a polyester polyol comprising monomeric units derived from aromatic monomers.

9. The kit of any preceding claim, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived from at least 50wt% polyester polyol relative to the total amount of polyols incorporated into the prepolymer.

10. The kit of any preceding claim, wherein the polyester polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived comprises monomeric units derived from aromatic dicarboxylic acids and monomeric units derived from aliphatic dicarboxylic acids.

11. The kit of any preceding claim, wherein the polyester polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is itself derived from 10 to 55wt% aromatic dicarboxylic acids, such as 15 to 45wt%, or 15 to 35wt% aromatic dicarboxylic acids.

12. The kit of any preceding claim, wherein the polyester polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is itself derived from 10wt% to 55wt% aliphatic dicarboxylic acids, such as 15 to 45wt%, or 15 to 35wt% aliphatic dicarboxylic acids.

13. The kit of any preceding claim, wherein the polyester polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived comprises monomer units derived from a mixture of linear and branched glycols; optionally wherein the linear and branched glycols have a molecular weight of less than 500  $\text{gmol}^{-1}$ , such as less than 200  $\text{gmol}^{-1}$ .

14. The kit of any preceding claim, wherein the polyester polyol and/or polyether polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived has a number average molecular weight of less than or equal to 1000 g/mol.

15. The kit of any preceding claim, wherein the polyester polyol and/or polyether polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is derived is linear.

16. The kit of any preceding claim, wherein the molar ratio of the NCO groups of the aliphatic isocyanate monomers to the HO groups of the polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is from 4:1 to 2:1, or from 3:1 to 2:1.

17. The kit of any preceding claim, wherein i) the polyol crosslinker is a linear or branched polyester polyol, or ii) the polyol crosslinker is a mixture of at least one linear or branched polyester polyol and at least one linear or branched polyether polyol.

18. The kit of any preceding claim, wherein the polyol crosslinker is a polyester polyol formed from one or more glycols and one or more dicarboxylic acids.

19. The kit of claim 18, wherein the one or more glycols are selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, propylene glycol, neopentyl glycol, tetramethylene glycol, polyethylene glycol, polypropylene glycol, polybutylene glycol, the methyl ether derivatives of any of the above glycols, and combinations thereof.

20. The kit of claims 18 or 19, wherein the dicarboxylic acid is selected from the group consisting of the aliphatic dicarboxylic acids: malonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, methylsuccinic acid, aspartic acid, malic acid, and the aromatic dicarboxylic acids: terephthalic acid, isophthalic acid, and combinations thereof.

21. The kit of any of claims 18 to 20, wherein the polyester polyol of the polyol crosslinker is derived from non-glycol polyols, such as trimethylolpropane.

22. The kit of any preceding claim, wherein the polyol crosslinker of the polyol crosslinker is a polyester polyol comprising tertiary amine groups in the backbone.

23. The kit of any preceding claim, wherein the further aliphatic polyisocyanate has a viscosity at 23 °C of 3,000 mPas or less, such as 2,000 mPas or less, 1,000 or less, or 500 or less.

24. The kit of any preceding claim, wherein the further aliphatic polyisocyanate is selected from the group consisting of hexamethylenediisocyanate trimer, hexamethylenediisocyanate allophanate, hexamethylenediisocyanate biuret, and combinations thereof.

25. The kit of any preceding claim, wherein the wt% ratio of the polyurethane prepolymer to the further polyisocyanate in the composition comprising the further aliphatic polyisocyanate is from 8:1 to 1:1, such as from 5:1 to 2:1, or 3:1 to 2:1.

26. A laminate adhesive comprising the components of the solvent-free, lamination adhesive kit according to any preceding claim mixed together in a single composition.

27. A retort pouch comprising the laminate adhesive of claim 26.

28. A method of providing a multi-laminate structure, comprising

a) forming a laminate adhesive from the components of the kit of any one of claims 1 to 25 or providing the laminate adhesive of claim 26; and

b) applying the laminate adhesive onto a flexible film.

29. The method of claim 28, wherein the flexible film is selected from the group consisting of polyethylene terephthalate, Nylon, aluminium, orientated polypropylene, cast polypropylene, low density polyethylene, linear low density polyethylene, vacuum modified polyethylene terephthalate, aluminium oxide-polyethylene terephthalate, silicon oxide-polyethylene terephthalate, aluminium oxide-orientated polypropylene, silicon oxide coated orientated polypropylene, aluminium oxide-orientated polyethylene, silicon oxide-orientated polyethylene, aluminium oxide-Nylon and silicon oxide-Nylon, and any coated film thereof.

30. The method of claims 28 or 29, comprising applying the adhesive at press speeds in excess of 50m/min, or in excess of 100m/min.

31. A laminate adhesive structure resulting from the method of any one or more of claims 28 to 30.

32. The structure of claim 31, which is suitable for the preparation of retort pouches wherein no delamination failures occur at retort conditions of 100°C, and greater.

33. A method of making the kit of any preceding claim, comprising the steps of:

a) reacting aliphatic isocyanate monomers with a polyester polyol and/or polyether polyol to obtain an isocyanate-functionalised, aliphatic polyurethane prepolymer comprising monomeric units derived from said aliphatic isocyanate monomers; wherein an aliphatic polyurethane prepolymer is formed from aliphatic isocyanates, wherein the identity of the isocyanate alone dictates the polyurethane as being aliphatic or aromatic, wherein an aliphatic isocyanate is one wherein the isocyanate group(s) is/are not directly attached to an aromatic ring;

wherein the aliphatic isocyanate monomers are diisocyanates selected from the group consisting of hexamethylene diisocyanate, isophorone diisocyanate, methylene dicyclohexyl

diisocyanate, xylylene diisocyanate, tetramethylxylylene diisocyanate, pentamethylene diisocyanate, and combinations thereof;

wherein the molar ratio of the NCO groups of the aliphatic isocyanate monomers to the HO groups of the polyol from which the isocyanate-functionalised, aliphatic polyurethane prepolymer is derived is from 5:1 to 2:1;

b) reducing the residual isocyanate monomer present in the aliphatic polyurethane prepolymer to less than 0.1% (w/w) of the prepolymer;

c) introducing a further aliphatic polyisocyanate selected from the group consisting of aliphatic polyisocyanate trimers, aliphatic polyisocyanate allophanates, aliphatic polyisocyanate biurets, aliphatic polyisocyanate oligomers, aliphatic polyisocyanate uretdiones, and combinations thereof; and

d) introducing a polyol crosslinker to the kit; wherein the polyol crosslinker is a linear or branched polyether polyol and/or a linear or branched polyester polyol; wherein the polyol crosslinker does not comprise a silane additive capable of reacting with isocyanates.

34. The method of claim 33, wherein the aliphatic isocyanate monomers are diisocyanates selected from the group consisting of isophorone diisocyanate, 1,6-hexane diisocyanate, xylylene diisocyanate, and combinations thereof.

35. The method of any one of claims 33 or 34, wherein the amount of isocyanate monomer is reduced by stripping the prepolymer using a series of one or more wiped-film evaporators and/or short-path evaporators.

36. The method of any one of claims 33 to 35, wherein the isocyanate-functionalised, aliphatic polyurethane prepolymer is the isocyanate-functionalised, aliphatic polyurethane prepolymer according to any one of claims 3 to 9.

37. The method of any one of claims 33 to 36, wherein step a) comprises reacting the aliphatic isocyanate with a polyester polyol.

38. The method of claim 37, wherein the polyester polyol is the polyester polyol according to any one of claims 10 to 15.

39. The method of any of claims 33 to 38, wherein before step a), the method further comprises the step of reacting a mixture of aromatic and aliphatic dicarboxylic acids with at least one polyol to form the polyester polyol.

40. The method of claim 39, wherein the at least one polyol is selected from the group consisting of neopentyl glycol, 1,6-hexanediol, 3-methyl,1-5-pentane diol, monoethylene glycol, and combinations thereof.

41. The method of any one of claims 33 to 40, wherein the kit is free of solvent.

42. Use of the kit according to any preceding claim for forming a laminate adhesive.

43. The use according to claim 42, wherein the laminate adhesive forms part of a retort packaging, such as a pouch.

44. Use of the kit according to any preceding claim to improve bonding strength under retort conditions of a multi-laminate structure formed from a flexible film and a laminate adhesive formed from said kit relative to a multi-laminate structure formed from said flexible film and a laminate adhesive not formed from the kit of the invention, wherein bonding strength is the strength required to separate at least two layers of the multi-laminate structure that are joined together with said adhesive and is measured at room temperature (25 °C) and at 100 mm/min.

45. The use according to claim 44, wherein the retort conditions comprise heating at 100 °C or higher for a period of 20 minutes, such as heating at 120 °C for 30 minutes at 1.5 bar, or heating at 135 °C for 20 minutes at 2.6 bar.

46. The use according to claims 44 or 45, wherein retort conditions comprise placing the multi-laminate structure in an autoclave with an internal pressure of 1.5 bar to 3 bar, such as 1.5 bar or 2.6 bar.

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