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(71) Applicant: DSM IP ASSETS, B.V. [NL/NL]; HET OVERLOON 1, 6411 TE HEERLEN (NL).

(72) Inventor; and

(71) Applicant: AL-RASHID, Jennifer Elizabeth [US/US]; DSM BIOMEDICAL, 735 Pennsylvania Drive, Exton, Pennsylvania 19341 (US).

(72) Inventors: ZUPANCICH, John Andrew; DSM BIOMEDICAL, 735 Pennsylvania Drive, Exton, Pennsylvania 19341 (US). PAULLIN, Jayme; DSM BIOMEDICAL, 735 Pennsylvania Drive, Exton, Pennsylvania 19341 (US). RIFFEY, Jacob Kyle; DSM BIOMEDICAL, 735 Pennsylvania Drive, Exton, Pennsylvania 19341 (US). KONTRA, Justin; DSM BIOMEDICAL, 735 Pennsylvania Drive, Exton, Pennsylvania 19341 (US).

(74) Agent: BULL, Kevin M.; DSM NORTH AMERICA INC., 1122 St. Charles Street, Elgin, Illinois 60120 (US).

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(54) Title: THERMOSETTING COMPOSITION FOR FORMING COMPONENTS OF RIGID, GAS PERMEABLE LENSES

(57) Abstract: Disclosed herein are compositions and kits of materials for forming a component of a rigid gas permeable lens. An exemplary composition comprises a) an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least: i) an aliphatic diisocyanate, and ii) a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol, b) a hydrophobic poly(alkylene oxide) diol, and c) a monomeric polyol or a propoxylate thereof. The average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5. Kits of materials comprising elements that when combined form the composition are also disclosed. Further disclosed are articles and ocular devices comprising components formed from the compositions or kits.



THERMOSETTING COMPOSITION FOR FORMING COMPONENTS OF RIGID, GAS PERMEABLE LENSES

Cross-Reference to Related Applications

5 This application is an international application claiming priority to US Provisional Application 62/521959, filed 19 June 2017, US Provisional Application 62/521964, filed 19 June 2017, European Patent Application EP17178706.2, filed 29 June 2017, and European Patent Application EP17178709.6, filed 29 June 2017, the entire contents of each of which is hereby incorporated by reference in its entirety.

Field

10 The disclosed inventions pertain to compositions and kits of materials that may be useful for forming components of rigid, gas permeable lenses, methods that may be used to form components of rigid, gas permeable lenses, and components of rigid, gas permeable
15 lenses formed therefrom.

Background

20 Contact lenses are typically made from silicone hydrogel materials. Silicone hydrogel contact lenses seek a balance of numerous properties to achieve optimal properties and patient comfort. Examples of these properties include oxygen permeability, wettability, lubricity, biocompatibility, physical strength, low modulus, and transparency. A low modulus is important because lower modulus lenses are more likely to conform to eye curvature, thereby resulting in improved user comfort.

25 Although silicone hydrogels achieve excellent optical clarity and oxygen permeability, their hardness and modulus are generally too low for certain biomedical applications, such as applications involving sensors. Other candidate materials, such as silicone or fluorinated acrylates, suffer from high shrinkage and/or high post-processing costs relating to mechanical finishing of the rigid material. Furthermore, existing rigid, gas permeable lenses have good hardness and oxygen permeability, but lack processing characteristics desirable for use in
30 certain biomedical applications.

To overcome these disadvantages, polyurethanes have been considered. Polyurethanes offer the advantages of easy handling, moldability, optical clarity, and high biocompatibility.

35 Polyurethane hydrogels are known to be useful in contact lenses. US2002/0032297 discloses a prepolymer prepared by reacting a mixture containing a) at least one multi-functional compound, b) at least one diisocyanate, and c) at least one diol. When reacted with

water, the pre-polymer forms a hydrogel polymer which may be reaction molded to form a contact lens.

WO2004/020495 discloses a method of producing thermoplastic hydrogels for use in contact lenses comprising the step of reaction one or more of a polyethylene oxide, a polyol, and/or a polyamine with a polyisocyanate and a polyfunctional amine or polyalcohol. Preferably, the polyol is polyethylene glycol. The thermoplastic hydrogels exhibit a high level of swelling after molding and swelling with water.

A further attempt at forming lenses from polyurethane polymers is disclosed in WO2016/005733. This document discloses a poly(ethylene glycol) (PEG) compound, a PEG-PDMS-PEG copolymer diol and/or a block copolymer of ethylene oxide and propylene oxide, a poly isocyanate compound, a polyfunctional compound having an average functionality greater than 2, and a chain extender such as di-propylene glycol.

Despite these documents, there is still a need for polyurethanes that are useful in forming components of rigid, gas permeable lenses and that are able to achieve a desired combination of optical clarity, biocompatibility, hardness, and modulus.

Summary

Although past attempts at polyurethane compositions that may be useful to form components of rigid, gas permeable lenses may achieve benefits in oxygen permeability, strength, and transparency, the hardness, modulus, and processing characteristics are insufficient for certain biomedical applications.

In accordance with an embodiment, a composition for forming a component of a rigid gas permeable lens comprises:

- a. an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least:
 - i. an aliphatic diisocyanate, and
 - ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,

- b. a free hydrophobic poly(alkylene oxide) diol, and

- c. a monomeric polyol, or a propoxylate thereof,

wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.

In accordance with an embodiment, a kit of materials comprises:

- a. A first element comprising an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least:

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- i. an aliphatic diisocyanate, and
- ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
- b. A second element comprising:
 - i. a free hydrophobic poly(alkylene oxide) diol, and
 - ii. a monomeric polyol, or a propoxylate thereof,
 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.

Detailed Description

In accordance with an embodiment, a composition for forming a component of a rigid gas permeable lens comprises:

- a. an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least:
 - i. an aliphatic diisocyanate, and
 - ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
 - b. a free hydrophobic poly(alkylene oxide) diol, and
 - c. a monomeric polyol, or a propoxylate thereof,
- wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.

In an embodiment, the elements of the composition are present as a multi-component kit. A thermosetting composition is formed when two or more parts of the kit are combined. The first element of the kit comprises isocyanate-functional components, such as the pre-polymer. The second element of the kit comprises hydroxyl-functional components, such as the hydrophobic poly(alkylene oxide) diol and the monomeric polyol, or a propoxylate thereof. In an embodiment, a first element of the kit comprises the pre-polymer and a second element of the kit comprises the hydrophobic poly(alkylene oxide) diol and the monomeric polyol, or a propoxylate thereof.

In accordance with an embodiment, a kit for forming a component of a rigid gas permeable lens comprises:

- a. A first element comprising an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least:
 - i. an aliphatic diisocyanate, and

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- ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,

b. A second element comprising:

- i. a free hydrophobic poly(alkylene oxide) diol, and
- ii. a monomeric polyol, or a propoxylate thereof,

wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.

The average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5. In an embodiment, the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is at least 4.6, at least 4.7, at least 4.8, or at least 4.9. In an embodiment, the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is at most 5.4, at most 5.3, at most 5.2, or at most 5.1. In an embodiment, the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is about 5.

In accordance with an embodiment, a composition for forming a component of a rigid gas permeable lens comprises a pre-polymer. A pre-polymer is a component containing a reactive functionality that can react with at least one other component of the composition or kit, and a subunit that repeats at least once. The pre-polymer is formed by reacting monomers and/or polymers separately from the other elements of the composition or kit under appropriate conditions.

The pre-polymer is isocyanate terminated. An isocyanate terminated pre-polymer may be formed when forming a pre-polymer from a surplus of diisocyanate substituents, such as diisocyanate monomers or polymers, relative to the other substituents of the pre-polymer. Alternatively, an isocyanate terminated pre-polymer may be formed by reacting an diisocyanate with a OH-functional polymer, such as a hydrophobic poly(alkylene oxide) diol or a polymeric siloxane diol. For example, polypropylene glycol can be reacted with diisocyanate monomers to form an isocyanate terminated pre-polymer.

The isocyanate terminated pre-polymer comprises one or more isocyanate groups per molecule. In an embodiment, the isocyanate terminated pre-polymer comprises an average of at least 1.7 isocyanate groups per molecule, at least 1.8 isocyanate groups per molecule, at least 1.9 isocyanate groups per molecule, 2 isocyanate groups per molecule, an average of at least 2.1 isocyanate groups per molecule, or an average of at least 2.2 isocyanate groups per

molecule. In an embodiment, the isocyanate terminated pre-polymer comprises an average of at most 3 isocyanate groups per molecule, an average of at most 2.7 isocyanate groups per molecule, an average of at most 2.5 isocyanate groups per molecule, an average of at most 2.4 isocyanate groups per molecule, an average of at most 2.3 isocyanate groups per molecule, an average of at most 2.2 isocyanate groups per molecule, or an average of at most 2.1 isocyanate groups per molecule. In embodiment, the isocyanate terminated pre-polymer comprises an average of from 1.8 to 2 isocyanate groups per molecule.

In an embodiment, the isocyanate terminated pre-polymer is a polyurethane. In an embodiment, the pre-polymer is linear. Typically, the pre-polymer is linear if it comprises the reaction product of only components having two functional groups, for instance, when the pre-polymer consists of the reaction product of an aliphatic diisocyanate and a diol. In an embodiment, the pre-polymer is branched. Branching can be achieved by, for instance, incorporating a component having three or more functional groups, such as a triol or tetraol, into the composition from which the pre-polymer is formed.

In an embodiment, a composition for forming a component of a rigid gas permeable lens comprises an isocyanate terminated pre-polymer that is the reaction product of at least i) an aliphatic diisocyanate, and ii) a diol component. The diol component comprises a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol. In an embodiment, the isocyanate terminated pre-polymer comprises a mixture of pre-polymers having different residues of an aliphatic diisocyanate and/or different residues of the diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol.

In an embodiment, at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of i) an aliphatic diisocyanate and ii) a siloxane diol, a fluorinated diol, or a hydrophobic poly(alkylene oxide) diol.

In an embodiment, at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a siloxane diol. In an embodiment, at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a fluorinated diol. In an embodiment, at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95

mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a hydrophobic poly(alkylene oxide) diol.

In an embodiment, the pre-polymer comprises less than 5 wt% of hydrophilic polymer or is devoid of hydrophilic polymer. In an embodiment, the pre-polymer comprises less than 5 wt% of hydrophilic poly(alkylene oxide) or is devoid of hydrophilic poly(alkylene oxide).

In an embodiment, the pre-polymer has a number average molecule weight (Mn) of at least 200 g/mol, at least 300 g/mol, at least 500 g/mol, at least 750 g/mol, at least 1000 g/mol, at least 1250 g/mol, or at least 1500 g/mol. In an embodiment, the pre-polymer has a Mn of at most 10000 g/mol, at most 7500 g/mol, at most 5000 g/mol, at most 4000 g/mol, at most 3000 g/mol, at most 2000 g/mol, or at most 1500 g/mol.

Throughout this application, number and weight average molecular weight are determined by gel permeation chromatography (GPC) using polystyrene standards and N,N-dimethyl formamide (DMF) as the solvent with a column temperature of 80 °C and a refractive index detector temperature of 53 °C. In the case that a molecule is not polymeric or oligomeric, the molecular weight is the sum of the atomic weights of each constituent element multiplied by the number of atoms of that element in the molecular formula.

The pre-polymer comprises the residue of an aliphatic diisocyanate. In an embodiment, the aliphatic diisocyanate comprises hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI). In an embodiment, the aliphatic diisocyanate consists of one or more of hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI).

The pre-polymer comprises the residue of a diol component. The diol component comprises a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol. In an embodiment, the diol component consists of one or more of a siloxane diol, a fluorinated diol, or a hydrophobic poly(alkylene oxide) diol. In an embodiment, the diol component comprises a siloxane diol and a hydrophobic poly(alkylene oxide) diol. In an embodiment, the diol component consists of a siloxane diol and a hydrophobic poly(alkylene oxide) diol.

The diol component may comprise a monomeric diol, a polymeric diol, or a mixture of a monomeric diol and a polymeric diol. In an embodiment, the diol component has a number average molecule weight (Mn) of at least 62 g/mol, at least 70 g/mol, at least 80 g/mol, at least 100 g/mol, at least 150 g/mol, at least 200 g/mol, at least 250 g/mol, at least 300 g/mol, at least 350 g/mol, or at least 400 g/mol. In an embodiment, the diol component has a Mn of at most 1000 g/mol, at most 900 g/mol, at most 800 g/mol, at most 700 g/mol, at most 600 g/mol, at most 500 g/mol, at most 400 g/mol, at most 300 g/mol, at most 200 g/mol, or at most 150 g/mol.

In an embodiment, the diol component comprises a siloxane diol. The siloxane diol may be monomeric or polymeric. In an embodiment, the diol component consists of a siloxane diol.

In an embodiment, the diol component consists of a monomeric siloxane diol. In an embodiment, the diol component consists of a polymeric siloxane diol. In an embodiment, the diol component consists of a blend of monomeric and polymeric siloxane diols.

In an embodiment, the siloxane diol comprises a monomeric siloxane diol. In an embodiment, the siloxane diol has a molecular weight of at least 200 g/mol or at least 300 g/mol. In an embodiment, the siloxane diol has a molecular weight of at most 600 g/mol or at most 500 g/mol. In an embodiment, the siloxane diol comprises 1,3-bis(hydroxypropyl)tetramethyldisiloxane, 1,3-bis(3-hydroxyisobutyl)tetramethyldisiloxane, 1,3-bis(4-hydroxybutyl)tetramethyldisiloxane, or 1,3-bis(3-(2-hydroxyethoxy)propyl)tetramethyldisiloxane.

In an embodiment, the siloxane diol comprises a polysiloxane diol. In an embodiment, the polysiloxane diol comprises a poly(dimethylsiloxane) diol. In an embodiment, the poly(dimethylsiloxane) diol comprises a hydroxyl terminated poly(dimethylsiloxane) or hydroxylalkyl terminated poly(dimethylsiloxane).

In an embodiment, the siloxane diol comprises a polysiloxane diol having a Mn of at least 1000 g/mol, at least 1200 g/mol, or at least 1500 g/mol. In an embodiment, the siloxane diol comprises a polysiloxane diol having a Mn of at most 10,000 g/mol, at most 9,000 g/mol, at most 8,000 g/mol, at most 7,000 g/mol, at most 6,000 g/mol, or at most 5,000 g/mol.

In an embodiment, the diol component comprises a fluorinated diol. In an embodiment, the diol component consists of a fluorinated diol. The fluorinated diol may be monomeric or polymeric. In an embodiment, the diol component comprises a fluorinated diol comprising 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, or 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol. In an embodiment, the diol component comprises a fluorinated diol that consists of 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol, or a blend thereof.

In an embodiment, the diol component comprises a hydrophobic poly(alkylene oxide) diol. In an embodiment, the diol component consists of a hydrophobic poly(alkylene oxide) diol. A hydrophobic poly(alkylene oxide) diol is a poly(alkylene oxide) diol that tends to repel and not absorb water, or to not be dissolvable in water. In an embodiment, the hydrophobic poly(alkylene oxide) diol comprises poly(propylene oxide) diol, poly(tetramethylene oxide) diol,

or a diol that comprises a copolymer of poly(propylene oxide) and poly(tetramethylene oxide). Poly(ethylene oxide) diol is not a hydrophobic poly(alkylene oxide) diol.

In an embodiment, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 80 mol%, at least 90 mol%, or 100 mol% of the hydrophobic poly(alkylene oxide) diol backbone is propylene oxide and/or tetramethylene oxide.

In an embodiment, the pre-polymer comprises the reaction product of: at least 10 wt%, at least 15 wt%, or at least 20 wt% of the aliphatic diisocyanate, and at least 30 wt%, at least 40 wt%, at least 50 wt%, at least 60 wt%, or at least 70 wt% of the diol component. In an embodiment, the pre-polymer comprises the reaction product of at most 50 wt%, at most 40 wt%, or at most 30 wt% of the aliphatic diisocyanate; and at most 90 wt%, at most 80 wt%, at most 70 wt%, or at most 60 wt%, of the diol component.

In an embodiment, the composition or kit comprises at least 30 wt%, at least 40 wt%, at least 50 wt%, or at least 60 wt% of isocyanate terminated pre-polymer. In an embodiment, the composition or kit comprises at most 90 wt%, at most 80 wt%, at most 75 wt%, or at most 70 wt% of the isocyanate terminated pre-polymer.

The composition or kit comprises a free hydrophobic poly(alkylene oxide) diol, i.e. hydrophobic poly(alkylene oxide) diol that is not incorporated into the pre-polymer. In an embodiment, the free hydrophobic poly(alkylene oxide) diol comprises poly(propylene oxide) diol, poly(tetramethylene oxide) diol, or a diol that comprises a copolymer of poly(propylene oxide) and poly(tetramethylene oxide). In an embodiment, the free hydrophobic poly(alkylene oxide) diol has a number average molecule weight (Mn) of at least 150 g/mol, at least 200 g/mol, at least 250 g/mol, at least 300 g/mol, at least 350 g/mol, or at least 400 g/mol. In an embodiment, the free hydrophobic poly(alkylene oxide) diol has a Mn of at most 1500 g/mol, at most 1200 g/mol, at most 1000 g/mol, at most 900 g/mol, at most 800 g/mol, at most 700 g/mol, at most 600 g/mol, at most 500 g/mol, or at most 450 g/mol. In an embodiment, the composition or kit comprises a free hydrophobic poly(alkylene oxide) diol having a Mn of less than 500 g/mol. In an embodiment, the free hydrophobic poly(alkylene oxide) diol is present in an amount of at least 10 wt%, at least 15 wt%, at least 20 wt%, or at least 25 wt%. In an embodiment, the free hydrophobic poly(alkylene oxide) diol is present in an amount of at most 60 wt%, at most 50 wt%, at most 40 wt%, or at most 35 wt%.

Mixtures of free hydrophobic poly(alkylene oxide) diols may also be present. In an embodiment, the composition or kit comprises a free hydrophobic poly(alkylene oxide) diol having a number average molecular weight of less than 500 g/mol and a free hydrophobic poly(alkylene oxide) diol having a number average molecular weight of greater than 600 g/mol.

The composition or kit comprises a monomeric polyol or a propoxylate thereof. C₂-C₄ oxylated polyols are also monomeric polyols if they are oxylated an average of once or less per OH group, and not monomeric if they are oxylated an average of more than once per OH

group. Therefore, glycerol propoxylate that is propoxylated once per OH group is both a monomeric polyol and a propoxylate of glycerol.

In embodiment, the monomeric polyol, or a propoxylate thereof is a monomeric diol, triol, or tetraol, or a propoxylate thereof. In embodiment, the monomeric polyol, or a propoxylate thereof is a monomeric triol or tetraol, or a propoxylate thereof. In an embodiment, the monomeric polyol, or a propoxylate thereof comprises glycerol, glycerol propoxylate, glycerol ethoxylate, 1,2,4-benzenetriol, 3-methyl-1,3,5-pentanetriol, pentaerythritol, pentaerythritol propoxylate, or pentaerythritol ethoxylate. In an embodiment, the monomeric polyol, or a propoxylate thereof consists of glycerol, pentaerythritol, or a mixture thereof. In an embodiment, the monomeric polyol, or a propoxylate thereof consists of glycerol propoxylate, pentaerythritol propoxylate, or a mixture thereof. In an embodiment, the monomeric polyol, or a propoxylate thereof has a molecular weight of from 90 to 500 g/mol. In an embodiment, the monomeric polyol, or a propoxylate thereof has a molecular weight of from 90 to 280 g/mol. In an embodiment, the monomeric polyol, or a propoxylate thereof is present in an amount of at least 1 wt%, at least 1.5 wt%, at least 2 wt%, or at least 2.5 wt%. In an embodiment, the monomeric polyol, or a propoxylate thereof is present in an amount of at most 12 wt%, at most 10 wt%, or at most 8 wt%.

In an embodiment, the composition or kit further comprises a chain extender. A chain extender is an alkane diol having from 2 to 20 carbon atoms, wherein one or more carbon atoms may be substituted with oxygen. If in the composition or kit, the monomeric polyol, or a propoxylate thereof, comprises three OH groups or more, then a diol that satisfies the preceding definition of a chain extender is considered a chain extender rather than a monomeric polyol, or a propoxylate thereof. Conversely, if in the composition or kit, there is no monomeric polyol, or a propoxylate thereof that comprises three OH groups or more, then a diol that satisfies the preceding definition of a chain extender is considered to be a monomeric polyol, or a propoxylate thereof, rather than a chain extender.

In an embodiment, the chain extender has a molecular weight of at least 60 g/mol, at least 70 g/mol, at least 80 g/mol, at least 90 g/mol, or at least 100 g/mol. In an embodiment, the chain extender has a molecular weight of at most 500 g/mol, at most from 400 g/mol, at most 300 g/mol, at most 200 g/mol, or at most 150 g/mol. In an embodiment, the chain extender comprises ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, or 1,8-octanediol. In an embodiment, the chain extender is present in an amount of from 0 to 10 wt% of the composition or kit. In an embodiment, the chain extender is present in an amount of from 2 to 10 wt% of the composition or kit.

In an embodiment, the composition or kit further comprises a free aliphatic diisocyanate. In an embodiment, the free aliphatic diisocyanate comprises hexamethylene diisocyanate

(HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI). In an embodiment, the free aliphatic diisocyanate consists of hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), isophorone diisocyanate (IPDI), or a mixture thereof. In an embodiment, the free aliphatic diisocyanate is present in an amount of from 0 to 10 wt% of the composition or kit. In an embodiment, the free aliphatic diisocyanate is present in an amount of from 1 to 10 wt% of the composition or kit.

In an embodiment, the composition or kit comprises less than 10 wt% of hydrophilic polymer. The hydrophilic polymer may show up as free hydrophilic polymer in the solution, or may be part of the pre-polymer. In an embodiment, the composition or kit comprises less than 8 wt% of hydrophilic polymer or less than 5 wt% of hydrophilic polymer. In an embodiment, the composition or kit is devoid of hydrophilic polymer. Examples of hydrophilic polymers are poly(ethylene oxide), polyethylene glycol, polyvinylpyrrolidones, and poly(2-oxazolines). At least 51 mol% of the hydrophilic polymer comprises hydrophilic units. In an embodiment, the composition or kit comprises less than 10 wt% of poly(ethylene oxide). In an embodiment, the composition or kit comprises less than 8 wt% of poly(ethylene oxide) or less than 5 wt% of poly(ethylene oxide). In an embodiment, the composition or kit is devoid of poly(ethylene oxide).

In an embodiment, the composition or kit further comprises a hydroxyl-terminated pre-polymer. A hydroxyl-terminated pre-polymer may be formed similarly to the isocyanate-terminated pre-polymer, but a hydroxyl-terminated pre-polymer comprises more than one OH group per molecule rather than more than one isocyanate group per molecule. In an embodiment, the composition or kit further comprises a hydroxyl-terminated pre-polymer in an amount of from 1 to 10 wt%.

In an embodiment, the composition or kit further comprises a free siloxane diol. The free siloxane diol may be monomeric or polymeric. In an embodiment, the free siloxane diol consists of a monomeric siloxane diol. In an embodiment, the free siloxane diol consists of a polymeric siloxane diol. In an embodiment, the free siloxane diol consists of a blend of monomeric and polymeric siloxane diols.

In an embodiment, the free siloxane diol comprises a monomeric siloxane diol. In an embodiment, the free siloxane diol has a molecular weight of at least 200 g/mol or at least 300 g/mol. In an embodiment, the free siloxane diol has a molecular weight of at most 600 g/mol or at most 500 g/mol. In an embodiment, the free siloxane diol comprises 1,3-bis(hydroxypropyl)tetramethyldisiloxane, 1,3-bis(3-hydroxyisobutyl)tetramethyldisiloxane, 1,3-bis(4-hydroxybutyl)tetramethyldisiloxane, or 1,3-bis(3-(2-hydroxyethoxy)propyl)tetramethyldisiloxane.

In an embodiment, the free siloxane diol comprises a polysiloxane diol. In an embodiment, the free polysiloxane diol comprises a poly(dimethylsiloxane) diol. In an embodiment, the free

poly(dimethylsiloxane) diol comprises a hydroxyl terminated poly(dimethylsiloxane) or hydroxylalkyl terminated poly(dimethylsiloxane).

In an embodiment, the free siloxane diol comprises a polysiloxane diol having a Mn of at least 1000 g/mol, at least 1200 g/mol, or at least 1500 g/mol. In an embodiment, the free siloxane diol comprises a polysiloxane diol having a Mn of at least 1000 g/mol, at least 1200 g/mol, or at least 1500 g/mol. In an embodiment, the free siloxane diol comprises a polysiloxane diol having a Mn of at most 10,000 g/mol, at most 9,000 g/mol, at most 8,000 g/mol, at most 7,000 g/mol, at most 6,000 g/mol, or at most 5,000 g/mol.

In an embodiment, the free siloxane diol is present in an amount of from 0 to 20 wt%. In an embodiment, the free siloxane diol is present in an amount of from 1 to 20 wt%. In an embodiment, the free siloxane diol is present in an amount of from 1 to 10 wt%.

In an embodiment, the composition or kit further comprises a free fluorinated diol. The free fluorinated diol may be monomeric or polymeric. In an embodiment, the free fluorinated diol comprises 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, or 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol. In an embodiment, the free fluorinated diol consists of 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol, or a blend thereof.

In an embodiment, the free fluorinated diol is present in an amount of from 0 to 10 wt%. In an embodiment, the free fluorinated diol is present in an amount of from 1 to 10 wt%. In an embodiment, the free fluorinated diol is present in an amount of from 1 to 6 wt%.

The composition is typically curable at temperatures of from 23 °C to 100 °C. In an embodiment, the composition or kit further comprises a catalyst. In an embodiment, the catalyst is stannous octoate or dibutyltin dilaurate. Amine catalysts may also be used.

In an embodiment, a component is formed from the composition. The composition may be formed by combining the elements of the kit. In an embodiment, the component has a thickness of from 1 micrometer to 1 millimeter. The formed components may be flat components, may be shaped, such as in the shape of a ring, a concave surface suitable to fit on a surface of the eye, or a convex surface. Other molded shapes, included those with surface microstructures, may also be created.

The components are typically clear or water white upon curing. In an embodiment, a component formed from the composition has a refractive index of from 1.48 to 1.515, or from 1.48 to 1.5.

In an embodiment, a component formed from the composition, after exposure to 95% relative humidity for 24 hours at 23 °C, has a water content of 10 wt% or less. In an embodiment, a component formed from the composition has an elastic modulus of 500 MPa or greater. In an embodiment, a component formed from the composition has a Dk/t of from 1 to 100. In an embodiment, a component formed from the composition has a Shore D hardness of from 60 to 80.

Potential advantages of the composition are that it easily handled, has a long pot-life, has good moldability, is optically clear, and has good biocompatibility. Moreover, the high hardness and modulus may allow for mounting of electrical circuitry, such as by patterning of conductive material or flip chip mounting. In an embodiment, an ocular device comprises a component formed from the composition and an electrical circuit mounted on the component. In an embodiment, a component formed from the composition may be overmolded with a hydrogel, such as a silicone hydrogel, to yield an oxygen permeable ocular device. In an embodiment, an ocular device comprises a component formed from the composition, an electrical circuit mounted on the component, and a hydrogel molded onto or around the component.

The Examples below further elucidate embodiments of the invention, but of course, should not be construed as in any way limiting the scope of the claims.

Examples

The following test procedures are used in the Examples.

Glass Transition Temperature (T_g)

T_g is determined via differential scanning calorimetry (DSC). The measurements are performed using a TA Instruments Discovery Q200. Samples are cut from films. The samples are weighed and sealed in an aluminum pan. The sample is cooled from room temperature to -90 °C at a ramp rate of 10 °C/min. The sample is then heated to 250 °C at 10 °C/min followed again by cooling to -90 °C at 10 °C/min. The sample is then heated again (second heating run) to 250 °C at 10 °C/min. The T_g of the material is determined during this second heating run.

Oxygen Permeability

Film samples are cut to the appropriate size and masked with foil to seal any leaks. The film thickness is measured. The film is mounted onto a Mocon OxTran 2/20 system and allowed to equilibrate to a constant gas transmission rate, utilizing compressed air as the test

gas and 99% nitrogen with 1% hydrogen as the carrier gas. The humidity is kept as close to 0 as possible. The equilibrium gas transmission rate is recorded and the gas permeability in Barrer is calculated.

5 *Modulus*

Dog bone shaped samples are punched from a film using a metal punch and a press. The samples are then submitted for mechanical testing using an Instron 5965-E2 and following ASTM D638.

10 *Hardness*

A PTC Instruments Model #307L, ASTM Type D durometer is used. Film samples are placed on the Shore D Hardness stage opposite a 5 kg counter weight. The measurement is completed at least 10 times in different locations and the average taken.

15 *Refractive Index*

Film samples are cut to the width of the Abbe Refractometer testing surface, with the clear edge facing the light source. Cinnamon oil (refractive index = 1.53) is used as the contact liquid. The measurement is completed at 25 °C. The measurement is taken at least three times and the average taken.

The components used in the Examples are shown in Table 0.1.

Table 0.1: Components used in the Examples

Ref	Component	CAS#	Manufacturer
Siloxane Diol	1,3-Bis-(3-hydroxybutyl)tetramethyldisiloxane	5931-17-9	Gelest Inc.
Polysiloxane Diol	Silanol terminated polydimethylsiloxane	70131-67-8	Gelest Inc.
PTMO250	Poly (tetrahydrofuran) Mn ~250 g/mol	25190-06-1	Sigma Aldrich
PPG425	Poly(propylene glycol) Mn ~425 g/mol	25322-69-4	Sigma Aldrich
PPG1000	Poly(propylene glycol) Mn ~1000 g/mol	25322-69-4	Sigma Aldrich
Glycerol	Glycerol	56-81-5	Alfa Aesar
Glycerol PO	Poly-G® 76-635 - Glycerol Propoxylate	25791-96-2	Monument Chemical
HDI	hexamethylene diisocyanate	822-06-0	TCI America
HMDI	4,4'-Diisocyanato-methylenedicyclohexane	5124-30-1	TCI America
IPDI	Isophorone diisocyanate	4098-71-9	TCI America
Fluorine Diol	1H,1H,6H,6H-Perfluoro-1,6-hexanediol (2,2,3,3,4,4,5,5-Octafluoro-1,6-hexanediol)	355-74-8	Exfluor Research Corporation
BD	1,4-butanediol	110-63-4	Sigma Aldrich
ED	1,2-Ethanediol	107-21-1	Sigma Aldrich
WP-260	BAYTEC® WP-260 – HMDI terminated prepolymer based on PPG; %NCO 25.8-27.0	N/A	Covestro
Catalyst	Stannous Octoate	301-10-0	Sigma Aldrich

5 Pre-Polymer Synthesis

The pre-polymers used in the examples are synthesized as follows.

Synthesis of siloxane pre-polymers. Dried Siloxane Diol (<150ppm water) is added to a 250 mL round bottom flask equipped with an overhead stirrer and a dry heating bath. The temperature of the heating bath is set to 70 °C and the temperature is monitored. Once the temperature reaches 70 °C, the HMDI is added. The reaction is allowed to continue until the

%NCO measured via titration matched the expected/calculated %NCO. Once the %NCO matched the theoretical, dried PPG, if any, is added to the mixture. The reaction is again allowed to react until the %NCO measured matched the %NCO desired. The compositions of the siloxane pre-polymers are shown in Table 0.2.

5

Table 0.2 – Siloxane Pre-polymers

Pre-polymer	Siloxane Diol (parts by wt)	HMDI (parts by wt)	PTMO250 (parts by wt)	Final % NCO	Mn (g/mol)
SPP1	13.4	99.9	9.5	19.5%	520
SPP2	13.4	99.7		24.1%	521
SPP3	37	100		14.9%	536

Synthesis of fluorinated pre-polymers. The specified amount of Fluorine Diol is dissolved in PPG using a round bottom flask and Syrris Reactor for stirring/heating. The solution is heated to 70 °C and sparged with N₂ overnight to ensure water levels were below 150 ppm. In a clean round bottom flask, the specified amount of HMDI is added and heated to 80 °C. Using an addition funnel, the PPG/Fluorinated Diol solution is added dropwise over 3 hours to prevent chain extension. The %NCO of the pre-polymer is monitored until the desired %NCO is achieved. The composition of the fluorinated pre-polymers is shown in Table 0.3.

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Table 0.3 – Fluorinated Pre-polymers

Pre-polymer	Fluorine Diol (parts by wt)	HMDI (parts by wt)	PPG425 (parts by wt)	Final % NCO	Mn (g/mol)
FPP1	20.0	226	25.2	25.9%	600
FPP2	13.7	199	17.1	26.5%	317

Composition Preparation and Film Formation

All compositions are generated using the following procedure. The OH functional components (PPG, PTMO, Glycerol, BD, and/or HD) are placed in an empty polypropylene mixing cup. The catalyst is then added to this mixture. The mixture is hand mixed using a disposable wooden mixer. After hand mixing, the appropriate amount of pre-polymer is added and the entire composition is placed into a centrifugal mixer. The mixture is mixed under vacuum at 2000 RPM and 20 kPa for 5 minutes in order to mix and degas the composition.

25

Example 1

Several compositions are formed according to the above procedures. The formed compositions are shown in Table 1.1, below. Where two Pre-Polymers are listed it means that that compositions comprises both listed pre-polymers, each pre-polymer in its stated amount.

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Table 1.1 – Example 1 Compositions

Exp.	Pre-Polymer (Name, wt%)	PTMO250 (wt%)	PPG425 (wt%)	PPG1000 (wt%)	Glycerol (wt%)	BD (wt%)	Fluorine Diol (wt%)	Catalyst (mg)
1-1	FPP1, 58.3	22.4		8.0	3.6		7.8	
1-2	FPP1, 59.6	25.3		8.2	3.7		3.3	
1-3	SPP2, 56.6	14.2	25.5		3.7			8.9
1-4	SPP2, 58.5	26.4		11.3	3.9			8.9
1-5	FPP1, 28.4; SPP2 28.4	27.4		11.7	4.1			8.8
1-6	FPP1, 29.6; SPP2 229.6	25.9		11.2	3.8			8.9
1-7	FPP1, 29.5; SPP2 29.5	26.0		11.1	3.7			8.9
1-8	FPP2, 57.03	27.34		11.72	3.91			
CE1	SPP3, 83.5				3.0	13.4		5.8

Each composition is cast into a silicon mold (10.2 cm diameter, 2 cm deep) and placed in a convection oven set to 95 °C for 12 hours. The rigid film (thickness ~1.2 mm) is then removed from the oven, and the properties are analyzed according to the above described procedures. The measured properties are shown in Table 1.2, below.

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Table 1.2 – Example 1 Measurements

Exp.	RI	Hardness (Shore D)	Modulus (MPa)	Dk/t (Barrer)	Tg (°C)
1-1	1.4971	61.8	1202	1.5	50.7
1-2	1.4977	63.5	1095	n/m	48.2
1-3	1.504	73.3	1115	0.6	32.0
1-4	1.51	75.4	673	1.3	35.3
1-5	1.526	68.9	23	0	31.2
1-6	1.505	69.4	652	1.4	31.3
1-7	1.507	70.5	683	1.3	34.2
1-8	1.5134	68.2	1162	2.5	18.6
CE1	1.504	81.5	Too brittle	1.8	56.3

Examples 1-1 through 1-8 may exhibit a desirable balance of properties. CE1, which does not contain a free hydrophobic poly(alkylene oxide) diol, is too brittle for use as a component of a rigid gas permeable lens.

10

Example 2

Compositions are formed according to the above procedures. The formed compositions are shown in Table 2.1, below.

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Table 2.1 – Example 2 Compositions

Exp.	Pre-Polymer (Name, wt%)	PPG425 (wt%)	Glycerol (wt%)	Glycerol PO (wt%)	ED	Catalyst (wt%)
2-1	WP-260, 62.3	30.2	7.6			0.015
2-2	WP-260, 65.9	16.9		10.5	6.8	0.0135

Each composition is cast into a silicon mold (10.2 cm diameter, 2 cm deep) and placed in a convection oven set to 95 °C for 12 hours. The rigid film (thickness ~1.2 mm) is then removed from the oven, and the properties are analyzed according to the above described procedures. The measured properties are shown in Table 1.2, below.

Table 2.2 – Example 2 Measurements

Exp.	RI	Tg (°C)
2-1	1.513	67
2-2	1.512	77

Example 3

Prepolymer synthesis. Dried polysiloxane diol and hydrophobic poly(alkylene oxide) diol (<150ppm water) are added to a 250 mL round bottom flask equipped with an overhead stirrer and a dry heating bath. The temperature of the heating bath is set to 70 °C and the temperature is monitored. Once the temperature reaches 70 °C, the diisocyanate is added. The catalyst is 0.02 wt% dibutyltin dilaurate. The reaction is allowed to continue until the %NCO measured via titration matched the expected/calculated %NCO. The reaction is again allowed to react until the %NCO measured matched the %NCO desired. The obtained pre-polymers have a hydroxyl functionality of 2. The compositions of the pre-polymers are shown in Table 3.1.

Table 3.1 – Example 3 Pre-polymers

Pre-polymer	IPDI (wt%)	HDI (wt%)	HMDI (wt%)	Polysiloxane Diol (wt%)	PTMO250 (wt%)	Mn (g/mol)
PP1	23.5			50.0	26.4	3158
PP2		18.9		53.0	28.0	3619
PP3			26.6	48.0	25.4	3247

Several compositions are formed according to the above procedures. The formed compositions are shown in Table 3.2, below.

Table 3.2 – Example 3 Compositions

Exp.	BAYTEC ® WP- 260	Pre- Polymer (Name, wt%)	PTMO250 (wt%)	PPG650 (wt%)	Glycerol (wt%)	Catalyst (mg)
3-1	68.7	PP2, 1.52	15.92	15.88		12.53
3-2	46.99	PP2, 1.62	11.28	40.11		13
3-3	48.1	PP2, 2.5	5.02	39.32	4.9	10

Additional Description of Exemplary Embodiments

- 5 1. A composition for forming a component of a rigid gas permeable lens comprising:
 - a. an isocyanate terminated pre-polymer having an average of more than one isocyanate group per molecule and that is the reaction product of at least:
 - 10 i. an aliphatic diisocyanate, and
 - ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
 - b. a free hydrophobic poly(alkylene oxide) diol, and
 - c. a monomeric polyol, or a propoxylate thereof,
 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.
- 15 2. A kit of materials for forming a component of a rigid gas permeable lens comprising:
 - a. A first element comprising an isocyanate terminated pre-polymer that is the reaction product of at least:
 - 20 i. an aliphatic diisocyanate, and
 - ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
 - b. A second element comprising:
 - i. a free hydrophobic poly(alkylene oxide) diol, and
 - ii. a monomeric polyol, or a propoxylate thereof,
 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.
- 25 3. The composition or kit according to any one of the preceding exemplary embodiments, wherein the isocyanate terminated pre-polymer comprises an average of at least 1.7 isocyanate groups per molecule, at least 1.8 isocyanate groups per molecule, at least
- 30

1.9 isocyanate groups per molecule, 2 isocyanate groups per molecule, an average of at least 2.1 isocyanate groups per molecule, or an average of at least 2.2 isocyanate groups per molecule.

4. The composition or kit according to any one of the preceding exemplary embodiments,
5 wherein the isocyanate terminated pre-polymer comprises an average of at most 3 isocyanate groups per molecule, an average of at most 2.7 isocyanate groups per molecule, an average of at most 2.5 isocyanate groups per molecule, an average of at most 2.4 isocyanate groups per molecule, an average of at most 2.3 isocyanate groups per molecule, an average of at most 2.2 isocyanate groups per molecule, or an average
10 of at most 2.1 isocyanate groups per molecule.
5. The composition or kit according to any one of the preceding exemplary embodiments, wherein the isocyanate terminated pre-polymer comprises an average of from 1.8 to 2 isocyanate groups per molecule.
6. The composition or kit according to any one of the preceding exemplary embodiments,
15 wherein the isocyanate terminated pre-polymer is a polyurethane.
7. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer is linear.
8. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer is branched.
9. The composition or kit according to any one of the preceding exemplary embodiments,
20 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is at least 4.6, at least 4.7, at least 4.8, or at least 4.9.
10. The composition or kit according to any one of the preceding exemplary embodiments,
25 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is at most 5.4, at most 5.3, at most 5.2, or at most 5.1.
11. The composition or kit according to any one of the preceding exemplary embodiments, wherein the average number of isocyanate groups of the isocyanate terminated pre-
30 polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is about 5.
12. The composition or kit according to any one of the preceding exemplary embodiments, wherein the isocyanate terminated pre-polymer comprises a mixture of pre-polymers having different residues of an aliphatic diisocyanate and/or different residues of the diol
35 component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol.

13. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of i) an aliphatic diisocyanate and ii) a siloxane diol, a fluorinated diol, or a hydrophobic poly(alkylene oxide) diol.
14. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a siloxane diol.
15. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a fluorinated diol.
16. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 20 mol%, at least 30 mol%, at least 40 mol%, at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 75 mol%, at least 80 mol%, at least 85 mol%, at least 90 mol%, at least 95 mol%, at least 98 mol%, or 100 mol% of the pre-polymer comprises the reaction product of an aliphatic diisocyanate and a hydrophobic poly(alkylene oxide) diol.
17. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer comprises less than 5 wt% of hydrophilic polymer or is devoid of hydrophilic polymer.
18. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer comprises less than 5 wt% of hydrophilic poly(alkylene oxide) or is devoid of hydrophilic poly(alkylene oxide).
19. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer has a number average molecule weight (Mn) of at least 200 g/mol, at least 300 g/mol, at least 500 g/mol, at least 750 g/mol, at least 1000 g/mol, at least 1250 g/mol, or at least 1500 g/mol.
20. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer has a Mn of at most 10000 g/mol, at most 7500 g/mol, at most 5000 g/mol, at most 4000 g/mol, at most 3000 g/mol, at most 2000 g/mol, or at most 1500 g/mol.

21. The composition or kit according to any one of the preceding exemplary embodiments, wherein the aliphatic diisocyanate comprises hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI).
- 5 22. The composition or kit according to any one of the preceding exemplary embodiments, wherein the aliphatic diisocyanate consists of one or more of hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI).
- 10 23. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of one or more of a siloxane diol, a fluorinated diol, or a hydrophobic poly(alkylene oxide) diol.
24. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a siloxane diol and a hydrophobic poly(alkylene oxide) diol.
- 15 25. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a siloxane diol and a hydrophobic poly(alkylene oxide) diol.
26. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a monomeric diol, a polymeric diol, or a mixture of a monomeric diol and a polymeric diol.
- 20 27. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component has a number average molecule weight (Mn) of at least 62 g/mol, at least 70 g/mol, at least 80 g/mol, at least 100 g/mol, at least 150 g/mol, at least 200 g/mol, at least 250 g/mol, at least 300 g/mol, at least 350 g/mol, or at least 400 g/mol.
- 25 28. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component has a Mn of at most 1000 g/mol, at most 900 g/mol, at most 800 g/mol, at most 700 g/mol, at most 600 g/mol, at most 500 g/mol, at most 400 g/mol, at most 300 g/mol, at most 200 g/mol, or at most 150 g/mol.
- 30 29. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a monomeric or polymeric siloxane diol.
30. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a blend of monomeric and polymeric siloxane diols.
- 35 31. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a siloxane diol.

32. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a monomeric siloxane diol.
33. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a polymeric siloxane diol.
- 5 34. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a blend of monomeric and polymeric siloxane diols.
35. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a monomeric siloxane diol that has a molecular
10 weight of at least 200 g/mol or at least 300 g/mol.
36. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a monomeric siloxane diol that has a molecular weight of at most 600 g/mol or at most 500 g/mol.
37. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises 1,3-bis(hydroxypropyl)tetramethyldisiloxane, 1,3-
15 bis(3-hydroxyisobutyl)tetramethyldisiloxane, 1,3-bis(4-hydroxybutyl)tetramethyldisiloxane, or 1,3-bis(3-(2-hydroxyethoxy)propyl)tetramethyldisiloxane.
38. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a hydroxyl terminated poly(dimethylsiloxane) or
20 hydroxylalkyl terminated poly(dimethylsiloxane).
39. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a polysiloxane diol having a Mn of at least 1000 g/mol, at least 1200 g/mol, or at least 1500 g/mol.
- 25 40. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a polysiloxane diol having a Mn of at most 10,000 g/mol, at most 9,000 g/mol, at most 8,000 g/mol, at most 7,000 g/mol, at most 6,000 g/mol, or at most 5,000 g/mol.
41. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a fluorinated diol.
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42. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a fluorinated diol.
43. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a fluorinated diol comprising 1H,1H,4H,4H-
35 Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-

Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, or 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol.

44. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a fluorinated diol that consists of 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol, or a blend thereof.
45. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a hydrophobic poly(alkylene oxide) diol.
46. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component consists of a hydrophobic poly(alkylene oxide) diol.
47. The composition or kit according to any one of the preceding exemplary embodiments, wherein the diol component comprises a hydrophobic poly(alkylene oxide) diol that comprises poly(propylene oxide) diol, poly(tetramethylene oxide) diol, or a diol that comprises a copolymer of poly(propylene oxide) and poly(tetramethylene oxide).
48. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 80 mol%, at least 90 mol%, or at least 100 mol% of the hydrophobic poly(alkylene oxide) diol backbone is propylene oxide and/or tetramethylene oxide.
49. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer comprises the reaction product of:
- a. at least 10 wt%, at least 15 wt%, or at least 20 wt% of the aliphatic diisocyanate, and
 - b. at least 30 wt%, at least 40 wt%, at least 50 wt%, at least 60 wt%, or at least 70 wt% of the diol component.
50. The composition or kit according to any one of the preceding exemplary embodiments, wherein the pre-polymer comprises the reaction product of:
- a. at most 50 wt%, at most 40 wt%, or at most 30 wt% of the aliphatic diisocyanate; and
 - b. at most 90 wt%, at most 80 wt%, at most 70 wt%, or at most 60 wt%, of the diol component.
51. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit comprises at least 30 wt%, at least 40 wt%, at least 50 wt%, or at least 60 wt% of the isocyanate terminated pre-polymer.

52. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit comprises at most 90 wt%, at most 80 wt%, at most 75 wt%, or at most 70 wt% of the isocyanate terminated pre-polymer.
53. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol comprises poly(propylene oxide) diol, poly(tetramethylene oxide) diol, or a diol that comprises a copolymer of poly(propylene oxide) and poly(tetramethylene oxide).
54. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol has a number average molecule weight (Mn) of at least 150 g/mol, at least 200 g/mol, at least 250 g/mol, at least 300 g/mol, at least 350 g/mol, or at least 400 g/mol.
55. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol has a Mn of at most 1500 g/mol, at most 1200 g/mol, at most 1000 g/mol, at most 900 g/mol, at most 800 g/mol, at most 700 g/mol, at most 600 g/mol, at most 500 g/mol, or at most 450 g/mol.
56. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol comprises a mixture of a hydrophobic poly(alkylene oxide) diol having a number average molecular weight of less than 500 g/mol and a free hydrophobic poly(alkylene oxide) diol having a number average molecular weight of greater than 600 g/mol.
57. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol is present in an amount of at least 10 wt%, at least 15 wt%, at least 20 wt%, or at least 25 wt%.
58. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free hydrophobic poly(alkylene oxide) diol is present in an amount of at most 60 wt%, at most 50 wt%, at most 40 wt%, or at most 35 wt%.
59. The composition or kit according to any one of the preceding exemplary embodiments, wherein at least 50 mol%, at least 60 mol%, at least 70 mol%, at least 80 mol%, at least 90 mol%, or 100 mol% of the free hydrophobic poly(alkylene oxide) diol backbone is propylene oxide or tetramethylene oxide.
60. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is a diol, triol, or tetraol.
61. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is a triol or tetraol.
62. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is a monomeric polyol.

63. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof comprises glycerol, glycerol propoxylate, glycerol ethoxylate, 1,2,4-benzenetriol, 3-methyl-1,3,5-pentanetriol, pentaerythritol, pentaerythritol propoxylate, or pentaerythritol ethoxylate.
- 5 64. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof comprises glycerol, glycerol propoxylate, pentaerythritol, or pentaerythritol propoxylate.
65. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof consists of glycerol, glycerol propoxylate, pentaerythritol, pentaerythritol propoxylate, or a mixture thereof.
- 10 66. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof consists of glycerol propoxylate, pentaerythritol propoxylate, or a mixture thereof.
67. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is a monomeric polyol and has a molecular weight of from 90 to 500 g/mol.
- 15 68. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is a monomeric polyol that has molecular weight of from 90 to 280 g/mol.
69. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is present in an amount of at least 1 wt%, at least 1.5 wt%, at least 2 wt%, or at least 2.5 wt%.
70. The composition or kit according to any one of the preceding exemplary embodiments, wherein the monomeric polyol, or a propoxylate thereof is present in an amount of at most 12 wt%, at most 10 wt%, or at most 8 wt%.
- 25 71. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit further comprises a chain extender.
72. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender is an alkane diol having from 2 to 20 carbon atoms, wherein one or more carbon atoms may be substituted with oxygen.
- 30 73. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender has a molecular weight of at least 60 g/mol, at least 70 g/mol, at least 80 g/mol, at least 90 g/mol, or at least 100 g/mol.
74. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender has a molecular weight of at most 500 g/mol, at most from 400 g/mol, at most 300 g/mol, at most 200 g/mol, or at most 150 g/mol.
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75. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender comprises ethylene glycol, diethylene glycol, propylene glycol, dipropylene glycol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, or 1,8-octanediol.
- 5 76. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender is present in an amount of from 0 to 10 wt% of the composition or kit.
77. The composition or kit according to any one of the preceding exemplary embodiments, wherein the chain extender is present in an amount of from 2 to 10 wt% of the
10 composition or kit.
78. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a free aliphatic diisocyanate.
79. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free aliphatic diisocyanate comprises hexamethylene diisocyanate (HDI),
15 hydrogenated methylene diphenyl diisocyanate (HMDI), or isophorone diisocyanate (IPDI).
80. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free aliphatic diisocyanate consists of hexamethylene diisocyanate (HDI), hydrogenated methylene diphenyl diisocyanate (HMDI), isophorone diisocyanate (IPDI),
20 or a mixture thereof.
81. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free aliphatic diisocyanate is present in an amount of from 0 to 10 wt% of the composition or kit.
82. The composition or kit according to any one of the preceding exemplary embodiments,
25 wherein the free aliphatic diisocyanate is present in an amount of from 1 to 10 wt% of the composition or kit.
83. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit comprises less than 10 wt% of hydrophilic polymer.
84. The composition or kit according to any one of the preceding exemplary embodiments,
30 wherein the composition or kit comprises less than 8 wt% of hydrophilic polymer or less than 5 wt% of hydrophilic polymer.
85. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit is devoid of hydrophilic polymer.
86. The composition or kit according to any one of the preceding exemplary embodiments,
35 wherein the composition or kit comprises less than 10 wt% of poly(ethylene oxide).

87. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit comprises less than 8 wt% of poly(ethylene oxide) or less than 5 wt% of poly(ethylene oxide).
- 5 88. The composition or kit according to any one of the preceding exemplary embodiments, wherein the composition or kit is devoid of poly(ethylene oxide).
89. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a catalyst.
90. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a hydroxyl-terminated pre-polymer.
- 10 91. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a hydroxyl-terminated pre-polymer in an amount of from 1 to 10 wt% of the composition or kit, or from 1 to 5 wt% of the composition or kit.
92. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a free siloxane diol.
- 15 93. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a monomeric or polymeric siloxane diol.
94. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a blend of monomeric and polymeric siloxane diols.
- 20 95. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol consists of a monomeric siloxane diol.
96. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol consists of a polymeric siloxane diol.
97. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol consists of a blend of monomeric and polymeric siloxane diols.
- 25 98. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a monomeric siloxane diol that has a molecular weight of at least 200 g/mol or at least 300 g/mol.
- 30 99. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a monomeric siloxane diol that has a molecular weight of at most 600 g/mol or at most 500 g/mol.
100. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises 1,3-bis(hydroxypropyl)tetramethyldisiloxane, 1,3-bis(3-hydroxyisobutyl)tetramethyldisiloxane, 1,3-bis(4-hydroxybutyl)tetramethyldisiloxane, or 1,3-bis(3-(2-hydroxyethoxy)propyl)tetramethyldisiloxane.
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101. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a hydroxyl terminated poly(dimethylsiloxane) or hydroxylalkyl terminated poly(dimethylsiloxane).
102. The composition or kit according to any one of the preceding exemplary
5 embodiments, wherein the free siloxane diol comprises a polysiloxane diol having a Mn of at least 1000 g/mol, at least 1200 g/mol, or at least 1500 g/mol.
103. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol comprises a polysiloxane diol having a Mn
10 of at most 10,000 g/mol, at most 9,000 g/mol, at most 8,000 g/mol, at most 7,000 g/mol, at most 6,000 g/mol, or at most 5,000 g/mol.
104. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol is present in an amount of from 0 to 20 wt%.
105. The composition or kit according to any one of the preceding exemplary
15 embodiments, wherein the free siloxane diol is present in an amount of from 1 to 20 wt%.
106. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free siloxane diol is present in an amount of from 1 to 10 wt%.
- 20 107. The composition or kit according to any one of the preceding exemplary embodiments, further comprising a free fluorinated diol.
108. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free fluorinated diol comprises 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-
25 hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, or 1H,1H,11H,11H-Perfluoro-3,6,9-trioxaundecan-1,11-diol.
109. The composition or kit according to any one of the preceding exemplary
30 embodiments, wherein the free fluorinated diol consists of 1H,1H,4H,4H-Perfluoro-1,4-butanediol, 1H,1H,5H,5H-Perfluoro-1,5-pentanediol, 1H,1H,6H,6H-perfluoro-1,6-hexanediol, 1H,1H,8H,8H-Perfluoro-1,8-octanediol, 1H,1H,9H,9H-Perfluoro-1,9-nonanediol, 1H,1H,10H,10H-Perfluoro-1,10-decanediol, 1H,1H,12H,12H-Perfluoro-1,12-dodecanediol, 1H,1H,8H,8H-Perfluoro-3,6-dioxaoctan-1,8-diol, 1H,1H,11H,11H-
35 Perfluoro-3,6,9-trioxaundecan-1,11-diol, or a blend thereof.

110. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free fluorinated diol is present in an amount of from 0 to 10 wt%.
- 5 111. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free fluorinated diol is present in an amount of from 1 to 10 wt%.
112. The composition or kit according to any one of the preceding exemplary embodiments, wherein the free fluorinated diol is present in an amount of from 1 to 6 wt%.
- 10 113. A composition formed by combining the elements of the kit according to any one of the preceding exemplary embodiments.
114. A method of forming a component, comprising the step of curing the composition according to any one of the preceding exemplary embodiments.
115. A method of forming a component comprising the steps of:
- 15 a. combining the elements of the kit according to any one of the preceding exemplary embodiments, thereby forming a composition, and
- b. curing the composition.
116. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments.
- 20 117. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component has a thickness of from 1 micrometer to 1 millimeter.
118. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component has a concave
- 25 surface suitable to fit on a surface of the eye.
119. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component has a refractive index of from 1.48 to 1.515.
120. A component formed from the composition, kit, or method according to any one
- 30 of the preceding exemplary embodiments, wherein the component has a refractive index of from 1.48 to 1.50.
121. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component, after exposure to 95% relative humidity for 24 hours at 23 °C, has a water content of 10 wt% or less.
- 35 122. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component has an elastic modulus of 500 MPa or greater.

123. A component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, wherein the component has a Shore D hardness of from 60 to 80.
124. A method comprising the steps of:
- 5 a. providing a component form from the composition, kit, or method according to any one of the preceding exemplary embodiments, and
- b. overmolding a hydrogel in contact with the component.
125. The method according to the previous exemplary embodiment, wherein the hydrogel is a silicone hydrogel.
- 10 126. A method comprising the steps of:
- a. providing a component form from the composition, kit, or method according to any one of the preceding exemplary embodiments, and
- b. mounting electrical circuitry on the component.
127. A method comprising the steps of:
- 15 a. providing a component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, and
- b. mounting electrical circuitry on the component by flip chip mounting.
128. A method comprising the steps of:
- a. providing a component formed from the composition, kit, or method according to any one of the preceding exemplary embodiments, and
- 20 b. mounting electrical circuitry on the component by patterning a conductive material.
129. An ocular device comprising a component formed from the composition, method, or kit according to any one of the preceding exemplary embodiments.
- 25 130. An ocular device comprising:
- a. a component formed from the composition, method, or kit according to any one of the preceding exemplary embodiments, and
- b. an electrical circuit mounted on the component.
131. An ocular device comprising:
- 30 a. a component formed from the composition, method, or kit according to any one of the preceding exemplary embodiments, and
- b. a hydrogel molded onto or around the component.
132. An ocular device comprising:
- a. a component formed from the composition, method, or kit according to any one of the preceding exemplary embodiments,
- 35 b. an electrical circuit mounted on the component, and
- c. a hydrogel molded onto or around the component.

133. The ocular device according to any one of the the previous exemplary embodiments, wherein the hydrogel is a silicone hydrogel.

Unless stated otherwise, any expression of wt% is based on the weight of the entire composition, in the case of a composition, or on the weight of the entire kit once all elements are combined, in case of a kit. The use of the terms “a” and “an” and “the” and similar referents in the context of describing the invention (especially in the context of the following claims) are to be construed to cover both the singular and the plural, unless otherwise indicated herein or clearly contradicted by context. The terms “comprising,” “having,” “including,” and “containing” are to be construed as open-ended terms (i.e., meaning “including, but not limited to,”) unless otherwise noted. Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein. The use of any and all examples, or exemplary language (e.g., “such as”) provided herein, is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention unless otherwise claimed. No language in the specification should be construed as indicating any non-claimed element as essential to the practice of the invention.

Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations of those preferred embodiments may become apparent to those of ordinary skill in the art upon reading the foregoing description. The inventors expect skilled artisans to employ such variations as appropriate, and the inventors intend for the invention to be practiced otherwise than as specifically described herein. Accordingly, this invention includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. While certain optional features are described as embodiments of the invention, the description is meant to encompass and specifically disclose all combinations of these embodiments unless specifically indicated otherwise or physically impossible.

Claims

1. A composition for forming a component of a rigid gas permeable lens comprising:
- 5 a. an isocyanate terminated pre-polymer that is the reaction product of at least:
- i. an aliphatic diisocyanate, and
- ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
- b. a free hydrophobic poly(alkylene oxide) diol, and
- c. a monomeric polyol, or a propoxylate thereof,
- 10 wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.
2. A kit of materials for forming a component of a rigid gas permeable lens comprising:
- 15 a. A first element comprising an isocyanate terminated pre-polymer that is the reaction product of at least:
- i. an aliphatic diisocyanate, and
- ii. a diol component comprising a siloxane diol, a fluorinated diol, and/or a hydrophobic poly(alkylene oxide) diol,
- b. A second element comprising:
- 20 i. a free hydrophobic poly(alkylene oxide) diol, and
- ii. a monomeric polyol, or a propoxylate thereof,
- wherein the average number of isocyanate groups of the isocyanate terminated pre-polymer plus the average number of hydroxyl groups of the monomeric polyol, or a propoxylate thereof is equal to from 4.5 to 5.5.
- 25 3. The composition or kit according to any one of the preceding claims, wherein the isocyanate terminated pre-polymer comprises an average of from 1.8 to 2 isocyanate groups per molecule.
4. The composition or kit according to any one of the preceding claims, wherein at least 80 mol% of the pre-polymer comprises the reaction product of i) an aliphatic diisocyanate
- 30 and ii) a siloxane diol, a fluorinated diol, or a hydrophobic poly(alkylene oxide) diol.
5. The composition or kit according to any one of the preceding claims, wherein the diol component has a number average molecule weight (Mn) of at least 100 g/mol and at most 1000 g/mol.
6. The composition or kit according to any one of the preceding claims, wherein the diol
- 35 component comprises a monomeric siloxane diol that has a molecular weight of at least 200 g/mol and at most 600 g/mol.

7. The composition or kit according to any one of the preceding claims, wherein the free hydrophobic poly(alkylene oxide) diol comprises poly(propylene oxide) diol, poly(tetramethylene oxide) diol, or a diol that comprises a copolymer of poly(propylene oxide) and poly(tetramethylene oxide).
- 5 8. The composition or kit according to any one of the preceding claims, wherein the free hydrophobic poly(alkylene oxide) diol has a number average molecule weight (M_n) of at least 150 g/mol and at most 1200 g/mol.
9. The composition or kit according to any one of the preceding claims, wherein the free hydrophobic poly(alkylene oxide) comprises a mixture of hydrophobic poly(alkylene
10 oxides) having a number average molecular weight of less than 500 g/mol and a free hydrophobic poly(alkylene oxide) having a number average molecular weight of greater than 600 g/mol.
10. The composition or kit according to any one of the preceding claims, wherein the monomeric polyol, or a propoxylate thereof comprises glycerol, glycerol propoxylate,
15 pentaerythritol, or pentaerythritol propoxylate.
11. The composition or kit according to any one of the preceding claims, wherein the monomeric polyol, or a propoxylate thereof is a monomeric polyol that has molecular weight of from 90 to 280 g/mol.
12. The composition or kit according to any one of the preceding claims, wherein the
20 composition or kit further comprises a chain extender, wherein the chain extender is an alkane diol having from 2 to 20 carbon atoms, wherein one or more carbon atoms may be substituted with oxygen.
13. The composition or kit according to any one of the preceding claims, wherein the composition or kit comprises less than 10 wt% of hydrophilic polymer.
- 25 14. A component formed from the composition or kit according to any one of the preceding claims.
15. An ocular device comprising:
 - a. a component formed from the composition or kit according to any one of the preceding claims,
 - 30 b. an electrical circuit mounted on the component, and
 - c. a hydrogel molded onto or around the component.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/038059

A. CLASSIFICATION OF SUBJECT MATTER INV. C08G18/10 C08G18/12 C08G18/24 C08G18/38 C08G18/66 C08G18/75 G02B1/04 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C08G G02B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2016/005733 A1 (OCUTEC LTD [GB]) 14 January 2016 (2016-01-14) cited in the application page 1, line 3 - line 6 page 48, line 13 - line 18 page 53, line 31 - page 54, line 3 examples 1-16 -----	1-15
A	EP 0 493 320 A2 (CIBA GEIGY AG [CH]) 1 July 1992 (1992-07-01) page 2, line 1 - line 9 examples -----	1-15
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
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Date of the actual completion of the international search	Date of mailing of the international search report	
5 September 2018	20/09/2018	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Paulus, Florian	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/038059

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