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(54) Title: VISCOELASTIC AND RETICULATED POLYURETHANE FOAM AND THE PREPARATION THEREOF

(57) Abstract: The present invention provides a polyol composition for preparing a viscoelastic and reticulated polyurethane foam, comprising a first polyether polyol b1), a second polyether polyol b2), a third polyether polyol b3), and a surfactant b6). The present invention also provides a viscoelastic and reticulated polyurethane foam prepared from said polyol composition, wherein the polyurethane foam has a ball rebound rate of less than 15% determined according to GB/T6670-2008.

Description

Viscoelastic and Reticulated Polyurethane
Foam and the Preparation thereof

TECHNICAL FIELD

The present invention provides a polyol composition for preparing a viscoelastic and reticulated polyurethane foam, comprising a first polyether polyol b1), a second polyether polyol b2), a third polyether polyol b3), and a surfactant b6). The present invention also provides a viscoelastic and reticulated polyurethane foam prepared from said polyol composition, wherein the polyurethane foam has a ball rebound rate of less than 15% determined according to GB/T6670-2008.

BACKGROUND

Viscoelastic and reticulated polyurethane foams are mainly composed of meridian skeleton of cells without or with only a small amount of cell wall membrane. This kind of polyurethane foams has a high air permeability and a larger cell size in addition to the viscoelasticity. Therefore, they are widely used in the fields of furniture, such as sofas, mattresses, pillows, mats, clothing, filters, and industrial packaging. Viscoelastic and reticulated polyurethane foams are generally prepared by two steps: i) preparing a polyurethane foam; and ii) reticulating the obtained polyurethane foam. The reticulating treatment is generally implemented by chemical etching process or explosive process. For example, the patent document CN104059244A discloses a process for producing a high-crystal-molecule slow-rebound polyurethane, said process is carried out by firstly preparing a viscoelastic polyurethane foam, and then processing in an explosive manner to obtain the slow-rebound polyurethane.

SUMMARY OF THE INVENTION

The present invention provides a polyol composition for preparing a viscoelastic and reticulated polyurethane foam, comprising

b1) a first polyether polyol, wherein the first polyether polyol is based on propylene oxide, and has a functionality of 2.6-3.2 and a hydroxyl number of 120-400 mgKOH/g, and the first polyether polyol has a content of 10-70 wt.%, based on total weight of the polyol composition;

b2) a second polyether polyol, wherein the second polyether polyol has 0-20 wt.% of ethylene oxide units based on total weight of the second polyether polyol, and the second polyether polyol has a functionality of 1.8-3.2 and a hydroxyl number of 45-115 mgKOH/g;

b3) a third polyether polyol, wherein the third polyether polyol has 50-100 wt.% of ethylene oxide units based on total weight of the third polyether polyol, and the third polyether polyol has a functionality of 2-8 and a hydroxyl number of 20-240 mgKOH/g; and

b6) a surfactant, wherein the surfactant has a content of 0.01-0.50 wt.%, based on total weight of the polyol composition.

In certain embodiments of the invention, the second polyether polyol b2) has a content of 5-60 wt.%, based on total weight of the polyol composition.

In other certain embodiments of the invention, the third polyether polyol b3) has a content of 5-50 wt.%, based on total weight of the polyol composition.

In further certain embodiments of the invention, the polyol composition further comprises:

b4) a monofunctional polyether, wherein the monofunctional polyether has a hydroxyl number of 10-45 mgKOH/g, and a content of 2-25 wt.%, based on total weight of the polyol composition.

In still further certain embodiments of the invention, the polyol composition further comprises:

b5) a fifth polyether polyol, wherein the fifth polyether polyol has 0-30 wt.% of ethylene oxide units based on total

weight of the fifth polyether polyol, and a functionality of 2-8 and a hydroxyl number of 10-40 mgKOH/g. Preferably, the fifth polyether polyol has a content of 2-25 wt.%, based on total weight of the polyol composition.

In still further certain embodiments of the invention, the polyol composition further comprises one or more chain extender(s).

The present invention also provides a viscoelastic and reticulated polyurethane foam, prepared from a composition comprising:

- A) an isocyanate component, wherein the isocyanate component comprises diphenyl methane diisocyanate or poly(diphenyl methane diisocyanate);
- B) an isocyanate-reactive component, wherein the isocyanate-reactive component comprises the above-mentioned polyol composition for preparing a viscoelastic and reticulated polyurethane foam.

In certain embodiments of the invention, the isocyanate component A) further comprises toluene diisocyanate.

In other certain embodiments of the invention, the viscoelastic and reticulated polyurethane foam has a ball rebound rate of less than 15% determined according to GB/T6670-2008.

The present invention also provides a process of preparing a viscoelastic and reticulated polyurethane foam, comprising a step of reacting the components comprising:

- A) an isocyanate component, wherein the isocyanate component comprises diphenyl methane diisocyanate or poly(diphenyl methane diisocyanate);
- B) an isocyanate-reactive component, wherein the isocyanate-reactive component comprises the above-mentioned polyol composition for preparing a viscoelastic and reticulated polyurethane foam.

In certain embodiments of the invention, the isocyanate

component A) further comprises toluene diisocyanate.

In other certain embodiments of the invention, the process doesn't comprise a step of chemical etching or explosive treatment.

DETAINED DESCRIPTION

I. Polyol composition for preparing a viscoelastic and reticulated polyurethane foam

The present invention provides a polyol composition for preparing a viscoelastic and reticulated polyurethane foam, wherein said polyol composition can be used to form a reticulated polyurethane foam without reticulating treatment, and the obtained polyurethane foam has suitable cell diameter, high air permeability and good viscoelasticity.

When used in the present invention, the functionality and hydroxyl number mean the average functionality and the average hydroxyl number in each case, unless otherwise indicated. The measurement of hydroxyl number is known for the skilled as such and described, for example, in Houben Weyl, Methoden der Organischen Chemie, vol. XIV/2 Makromolekulare Stoffe, p. 17, Georg Thieme Verlag; Stuttgart 1963, which is incorporated by reference herein in its entirety.

When used in the present invention, the polyether polyol is well-known for the skilled in the art, which can be prepared by known processes. For example, it can be obtained by the reaction of alkylene oxide and an initiator in the presence of a catalyst. The catalyst is, preferably but not limited to, alkali hydroxides, alkali alkoxides, antimony pentachloride, boron fluoride etherate, or a mixture thereof. The alkylene oxide is, preferably but not limited to, tetrahydrofuran, ethylene oxide, propylene oxide, 1,2-butylene oxide, 2,3-butylene oxide, styrene oxide, or a mixture thereof; in particular preferably ethylene oxide and/or propylene oxide. The initiator is, preferably but not

limited to, a polyhydroxy or polyamine compound. The polyhydroxy compound is, preferably but not limited to, water, ethylene glycol, 1,2-propanediol, 1,3-propanediol, diethylene glycol, trimethylolpropane, glycerol, bisphenol A, bisphenol S or a mixture thereof. The polyamine compound is, preferably but not limited to, ethylene diamine, propylene diamine, butylene diamine, hexamethylene diamine, diethylenetriamine, tolylenediamine or a mixture thereof. In a preferred embodiment of the present invention, the polyether polyols including the first polyether polyol b1), the second polyether polyol b2), the third polyether polyol b3) and the fifth polyether polyol b5) are based on ethylene oxide and/or propylene oxide.

The first polyether polyol b1) is based on propylene oxide, that means the alkylene oxide used for preparing the first polyether polyol is propylene oxide. Said first polyether polyol has a functionality of 2.6-3.2 and a hydroxyl number of 120-400 mgKOH/g, and the first polyether polyol has a content of 10-70 wt.%, based on total weight of the polyol composition;

The second polyether polyol b2) has 0-20 wt.% of ethylene oxide units, a functionality of 1.8-3.2 and a hydroxyl number of 45-115 mgKOH/g. Preferably, the second polyether polyol b2) has a content of 5-60 wt.%, based on total weight of the polyol composition.

The third polyether polyol b3) has 50-100 wt.% of ethylene oxide units based on total weight of the third polyether polyol, and the third polyether polyol has a functionality of 2-8 and a hydroxyl number of 20-240 mgKOH/g. Preferably, the third polyether polyol b3) has a content of 5-50 wt.%, based on total weight of the polyol composition.

The polyol composition provided according to the invention further comprises the surfactant b6), wherein the surfactant has a content of 0.01-0.50 wt.%, based on total weight of the polyol composition used for preparing a viscoelastic and

reticulated polyurethane foam. Said surfactant can be those commonly used in the preparation of polyurethane foams. In a preferred embodiment of the present invention, the surfactant b6) is selected from the group comprising silicones, for example but not limited to Niax L-618 (available from Momentive) and Tegostab B8002 (available from Enovik). In further certain embodiments of the present invention, the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam further comprises:

b4) a monofunctional polyether, wherein the monofunctional polyether can be obtained by the reaction of a monohydric alcohol selected from C1-C20 aliphatic or aromatic monohydric alcohols and an alkylene oxide selected from ethylene oxide and/or propylene oxide. The monofunctional polyether has a hydroxyl number of 10-45 mgKOH/g, and a content of 2-25 wt.%, based on total weight of the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam. In further certain embodiments of the present invention, the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam further comprises:

b5) a fifth polyether polyol, wherein the fifth polyether polyol has 0-30 wt.% of ethylene oxide units based on total weight of the fifth polyether polyol, and a functionality of 2-8 and a hydroxyl number of 10-40 mgKOH/g. Preferably, the fifth polyether polyol has a content of 2-25 wt.%, based on total weight of the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam.

In certain embodiments of the present invention, the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam further comprises one or more chain extender(s). Examples of said chain extenders include, but are not limited to ethylene glycol, 1,2- and 1,3-propanediol, 1,3-, 1,4- and 2,3-butanediol, 1,6-hexanediol, 1,8-octanediol, 1,10-decanediol, neopentyl glycol, 1,3- and 1,4-bis(hydroxymethyl) cyclohexane, 2-methyl-1,3-propanediol, diethylene glycol, triethylene

glycol, tetraethylene glycol, polyethylene glycol, dipropylene glycol, tripropylene glycol, polypropylene glycol, dibutylene glycol, tributylene glycol, polybutylene glycol, N-methyl-diethanolamine, cyclohexane dimethanol, 2-methyl-1,3-propanediol, 2,2,4-trimethyl-pentane-1,3-diol, 1,2-ethylenediamine, 1,3-propanediamine, 1,4-butanediamine, hexamethylenediamine, isophoronediamine, 1,4-cyclohexanediamine, N,N'-diethyl-phenylenediamine, 2,4-diaminotoluene, 2,6-diaminotoluene.

In certain embodiments of the present invention, the polyol composition used for preparing a viscoelastic and reticulated polyurethane foam may further comprise a blowing agent, a catalyst and other ingredients.

The blowing agent according to the present invention may be a variety of physical blowing agents or chemical blowing agents. Examples of said blowing agent are, preferably but not limited to, water, halogenated hydrocarbons, hydrocarbons and gases. The halogenated hydrocarbons are preferably, but not limited to, monochlorodifluoromethane, dichloromonofluoromethane, dichlorofluoromethane, trichlorofluoromethane, or a mixture thereof. The hydrocarbons are preferably, but not limited to, butane, pentane, cyclopentane, hexane, cyclohexane, heptane, or a mixture thereof. The gases are preferably, but not limited to, air, CO₂ or N₂. The blowing agent is particularly preferably water. The amount of the blowing agent is dependent on the desired density of the polyurethane.

The catalyst according to the present invention is preferably, but not limited to, amine catalysts, organic metal catalysts, or a mixture thereof. Said amine catalysts are preferably, but not limited to, triethylamine, tributylamine, triethylenediamine, N-ethylmorpholine, N,N,N',N'-tetramethyl-ethylene diamine, pentamethyl-diethylene triamine, N,N-methylaniline, N,N-dimethylaniline, or a mixture thereof. Said organic metal catalysts are preferably, but not limited to, organotin compounds, for example, tin(II) acetate, tin(II) octoate, tin

ethylhexanoate, tin laurate, dibutyltin oxide, dibutyltin dichloride, dibutyltin diacetate, dibutyltin maleate, dioctyltin diacetate and combinations thereof.

II. Reticulated polyurethane foam

The present invention also provides a viscoelastic and reticulated polyurethane foam, prepared from a composition comprising:

A) an isocyanate component, wherein the isocyanate component comprises diphenyl methane diisocyanate or poly(diphenyl methane diisocyanate);

B) an isocyanate-reactive component, wherein the isocyanate-reactive component comprises the above-mentioned polyol composition for preparing a viscoelastic and reticulated polyurethane foam.

The isocyanate index of the composition used for preparing said reticulated polyurethane foam is 70-110, preferably 80-105, more preferably 85-100. The isocyanate index (X) is calculated as follows:

$$X(\%) = [(\text{mol of isocyanate groups (NCO groups) in component A}) : (\text{mol of isocyanate-reactive groups in component B})] \cdot 100\%$$

In certain embodiments of the present invention, the isocyanate component A) further comprises toluene diisocyanate.

The density of the reticulated polyurethane foam provided according to the invention is 25-100 kg/m³, determined in accordance with GB/T6343-1995.

The number of cells of the reticulated polyurethane foam provided according to the invention is 4-40 cells/25mm.

The air permeation rate of the reticulated polyurethane foam provided according to the invention is more than 50 L/min, determined according to ASTM D3574-11 Test G with a pressure difference of 20 Pa.

The ball rebound rate of the reticulated polyurethane foam provided according to the invention is less than 15% determined according to GB/T6670-2008.

The recovery time of the reticulated polyurethane foam provided according to the invention is 3-15 seconds determined according to ASTM D3574-11.

The reticulated polyurethane foam according to the present invention can be used e.g. as sofa cushions, mattresses, pillows, mats, shoulder pads for clothing, bra cotton, insoles, shoe tongue, shoe edge, as well as filter materials for dust mask, microphone and automobile exhaust pipes and other equipments and systems, explosion-proof materials for aircraft fuel tanks, ceramic filter material matrix and nickel foam substrate.

III. Process of preparing a reticulated polyurethane foam
The present invention also provides a process of preparing a viscoelastic and reticulated polyurethane foam, comprising a step of reacting the above-mentioned isocyanate component A) and the above-mentioned isocyanate-reactive component B), wherein a viscoelastic and reticulated polyurethane foam can be prepared according to said process without further reticulating step.

The viscoelastic and reticulated polyurethane foam according to the present invention can be prepared by using methods well known in the art. The methods may include continuous or discontinuous free-foaming block foam method and molded foam method. In one embodiment of the invention, the isocyanate and isocyanate-reactive components are continuously mixed in a foaming machine with the mixing head, and then overflow into the groove on a conveyor. Alternatively, the reaction mixture was applied directly onto the conveyor. When the foam moves downwards along the conveyor, the foam expands to form a continuous block foam, which is cut into segments or blocks with the required length for curing and storage.

After curing for one or more days, these foams can be cut into the desired shapes for end-use.

In a discontinuous process, the reaction components are mixed by a mixing head or in a mixing chamber. Then the reaction mixture was applied to a suitable container, in which the foam expands to form a foam with the container's size.

The viscoelastic and reticulated polyurethane foam according to the present invention may also be prepared by a molded foam method. The molded foam method typically employs one-pot feeding method, wherein the isocyanate component and the isocyanate-reactive component are mixed before injection, the mold is then closed, the foam expands to fill the mold to form a reticulated polyurethane foam with the shape and size of the mold.

EXAMPLES

In this application, all the parts and percentages are based on weight parts and weight percentages, unless otherwise indicated. The starting materials used in this application are described as follows:

Isocyanate 1: toluene diisocyanate with a NCO content of 48.3% and a functionality of 2;

Isocyanate 2: poly(diphenyl methane diisocyanate) with a NCO content of 32–33 wt.% and a functionality of 2.3;

Polyether polyol 1: glycerin initiated polyether polyol with 0% of ethylene oxide, a functionality of 3 and a hydroxyl number of 350 mgKOH/g;

Polyether polyol 2: glycerin initiated polyether polyol with 9% of ethylene oxide, a functionality of 3 and a hydroxyl number of 56 mgKOH/g;

Polyether polyol 3: propylene glycol initiated polyether polyol with 0% of ethylene oxide, a functionality of 2 and a hydroxyl number of 56 mgKOH/g;

Polyether polyol 4: glycerin initiated polyether polyol with 73% of ethylene oxide, a functionality of 3 and a hydroxyl number of 37 mgKOH/g;

Monofunctional polyether 5: with 80% of ethylene oxide, a functionality of 1 and a hydroxyl number of 53 mgKOH/g;

Polyether polyol 6: glycerin initiated polyether polyol with 13% of ethylene oxide, a functionality of 3 and a hydroxyl number of 35 mgKOH/g;

Niax L-618: surfactant, available from Momentive;

Tegostab B8002: surfactant, available from Enovik;

Niax A-1: catalyst, available from Momentive;

Dabco 33LV: catalyst, available from Air Products.

Polyether polyol, blowing agent, surfactant, catalyst, and optional other non-isocyanate additives were added to a 5 Liter plastic beaker. With a stirrer having three impellers (a mixing head having a diameter of about 7 cm), the reaction mixture was mixed at a rotational speed of 2000 rpm for 30

seconds. After adding the isocyanate component, it was quickly mixed for another seven seconds. The mixture was poured into a foaming box, in which it foams freely until the completion of the reaction. The temperature of the starting materials before the reaction was controlled at 23 ± 1 ° C. The foam was tested in terms of a variety of properties after aging in 72 hours.

Foam density is tested according to GB/T 6343-1995.

Indentation hardness is tested according to GB/T 10807-2006, with a sample size of 380mm × 380mm × 50mm.

The number of cells is counted pro unit of a straight line distance (25mm).

Ball rebound rate is tested according to GB/T6670-2008.

Foam recovery time is tested according to ASTM D3574-11 Test M.

Air permeability is tested according to ASTM D3574-11 Test G as follows: in the present application, the air pressure difference on both sides of the foam is kept at 20 Pa, and the air permeability is measured as the amount of air permeated through the foam sample pro unit of time.

Tensile strength is tested according to GB/T 6344-2008.

Elongation at break is tested according to GB/T 6344-2008. Table 1 indicates the formulations and properties of viscoelastic and reticulated soft polyurethane foams.

Table 1: the formulations and properties of viscoelastic and reticulated soft polyurethane foams

Example	1	2	3	4
Polyether polyol 1	30	30	30	30
Polyether polyol 2	30	30	30	
Polyether polyol 3				20
Polyether polyol 4	40	40	30	40
monofunctional polyether 5			10	
Polyether polyol 6				10
water	1.8	1.8	1.8	1.6
Niax L-618	0.07	0.05	0.07	
Tegostab B8002				0.25
Niax A-1	0.20	0.20	0.20	0.20
Dabco 33LV	0.14	0.14	0.14	0.14
1, 4-butandiol		1.0		1.0
Isocyanate 1	22.6			
Isocyanate 2	22.6	54	49	48
Isocyanate index	98	90	90	85
Foam performance				
density (kg/m ³)	43.0	47.8	48.1	53.8
indentation force deflection 40% (N)	42	57	28	38
Cell amount (25mm each)	10	7	16	25
rebound rate (%)	5	4	5	9
Foam recovery time (s)	4.8	13.8	4.5	5.1
air permeation rate (L/min)	134	162	131	72
Tensile Strength (kPa)	67	55	45	86
elongation at break (%)	162	138	158	184
tear strength (N/m)	340	351	200	263

As can be seen from the formulations and properties of the foams in Table 1, the polyurethane foams directly obtained according to the present invention, without reticulating treatment after foaming, have a larger cell diameter, high air permeability and good viscoelasticity.

Claims

1. A polyol composition for preparing a viscoelastic and reticulated polyurethane foam, comprising
 - b1) a first polyether polyol, wherein the first polyether polyol is based on propylene oxide, and has a functionality of 2.6-3.2 and a hydroxyl number of 120-400 mgKOH/g, and the first polyether polyol has a content of 10-70 wt.%, based on total weight of the polyol composition;
 - b2) a second polyether polyol, wherein the second polyether polyol has 0-20 wt.% of ethylene oxide units based on total weight of the second polyether polyol, and the second polyether polyol has a functionality of 1.8-3.2 and a hydroxyl number of 45-115 mgKOH/g;
 - b3) a third polyether polyol, wherein the third polyether polyol has 50-100 wt.% of ethylene oxide units based on total weight of the third polyether polyol, and the third polyether polyol has a functionality of 2-8 and a hydroxyl number of 20-240 mgKOH/g; and
 - b6) a surfactant, wherein the surfactant has a content of 0.01-0.50 wt.%, based on total weight of the polyol composition.
2. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to claim 1, wherein the second polyether polyol b2) has a content of 5-60 wt.%, based on total weight of the polyol composition.
3. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to claim 1, wherein the third polyether polyol b3) has a content of 5-50 wt.%, based on total weight of the polyol composition.
4. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to any one of claims 1-3, wherein the polyol composition further comprises:
 - b4) a monofunctional polyether, wherein the monofunctional polyether has a hydroxyl number of 10-45 mgKOH/g, and a content

of 2-25 wt.%, based on total weight of the polyol composition.

5. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to any one of claims 1-3, wherein the polyol composition further comprises:

b5) a fifth polyether polyol, wherein the fifth polyether polyol has 0-30 wt.% of ethylene oxide units based on total weight of the fifth polyether polyol, and a functionality of 2-8 and a hydroxyl number of 10-40 mgKOH/g.

6. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to claim 5, wherein the fifth polyether polyol has a content of 2-25 wt.%, based on total weight of the polyol composition.

7. The polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to any one of claims 1-3, wherein the polyol composition further comprises one or more chain extender(s).

8. A viscoelastic and reticulated polyurethane foam, prepared from a composition comprising:

A) an isocyanate component, wherein the isocyanate component comprises diphenyl methane diisocyanate or poly(diphenyl methane diisocyanate);

B) an isocyanate-reactive component, wherein the isocyanate-reactive component comprises the polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to any one of claims 1-7.

9. The viscoelastic and reticulated polyurethane foam according to claim 8, wherein the isocyanate component A) further comprises toluene diisocyanate.

10. The viscoelastic and reticulated polyurethane foam according to claim 9, wherein the viscoelastic and reticulated polyurethane foam has a ball rebound rate of less than 15% determined according to GB/T6670-2008.

11. A process of preparing a viscoelastic and reticulated polyurethane foam, comprising a step of reacting the components comprising:

A) an isocyanate component, wherein the isocyanate component comprises diphenyl methane diisocyanate or poly(diphenyl methane diisocyanate);

B) an isocyanate-reactive component, wherein the isocyanate-reactive component comprises the polyol composition for preparing a viscoelastic and reticulated polyurethane foam according to any one of claims 1-7.

12. The process of preparing a viscoelastic and reticulated polyurethane foam according to claim 11, wherein the isocyanate component A) further comprises toluene diisocyanate.

13. The process of preparing a viscoelastic and reticulated polyurethane foam according to claim 11 or 12, wherein the process doesn't comprise a step of chemical etching or explosive treatment.

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER				
INV.	C08L71/02	C08G18/48	C08G18/66	C08G18/72
	C08G18/18	C08G18/20	C08G18/28	C08G18/32

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)

C08L C08G

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.
X	US 2013/178550 A1 (AOU KAORU [US] ET AL) 11 July 2013 (2013-07-11) paragraphs [0072], [0074], [0075], [0077], [0080] examples 2-11; table 1	1-7
A	----- US 2013/289150 A1 (HAGER STANLEY L [US] ET AL) 31 October 2013 (2013-10-31) paragraphs [0039], [0041], [0043] examples 1-5; table 1	8-13
X	----- US 2013/178548 A1 (AOU KAORU [US] ET AL) 11 July 2013 (2013-07-11) paragraphs [0069], [0070], [0071], [0075] examples A05,A10,B05,B10; table 1	1-7
A	----- ----- -/-	8-13

Further documents are listed in the continuation of Box C.

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/225706 A1 (MA HONGMING [US] ET AL) 29 August 2013 (2013-08-29) paragraphs [0072], [0073], [0074] examples 2-11; table 1 -----	1-7
A		8-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2016/062989

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
US 2013178550	A1 11-07-2013	CN 103228690 A EP 2621985 A1 US 2013178550 A1 WO 2012050671 A1			31-07-2013 07-08-2013 11-07-2013 19-04-2012
US 2013289150	A1 31-10-2013	CN 104662072 A EP 2841492 A1 US 2013289150 A1 WO 2013163143 A1			27-05-2015 04-03-2015 31-10-2013 31-10-2013
US 2013178548	A1 11-07-2013	AU 2011307525 A1 CN 103180358 A EP 2621984 A1 ES 2534299 T3 JP 2013538916 A US 2013178548 A1 WO 2012044414 A1			21-03-2013 26-06-2013 07-08-2013 21-04-2015 17-10-2013 11-07-2013 05-04-2012
US 2013225706	A1 29-08-2013	AU 2011299421 A1 CN 103154068 A EP 2614098 A1 ES 2565762 T3 JP 5941468 B2 JP 2013536897 A KR 20140001829 A US 2013225706 A1 WO 2012033674 A1			21-02-2013 12-06-2013 17-07-2013 06-04-2016 29-06-2016 26-09-2013 07-01-2014 29-08-2013 15-03-2012