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(54) **LUBRICATING OIL COMPOSITION FOR SHOCK ABSORBER**

(57) To provide a lubricating oil composition for a shock absorber for preventing wearing a piston rod and a guide bush in a shock absorber, which composition lowers the friction coefficient at the interface between bronze and chromium and reduces wear area of bronze.

The lubricating oil composition for a shock absorber

contains (A) a base oil composed of a mineral oil and/or a synthetic oil, and (B) a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue, in an amount of 0.05 mass% to 10 mass%, with respect to the total amount of the composition.

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Description

Technical Field

5 **[0001]** The present invention relates to a lubricating oil composition for a shock absorber. More specifically, the present invention relates to a lubricating oil composition for a shock absorber mainly used at a sliding part between a guide bush and a piston rod in a shock-absorber of a four-wheeled vehicle.

Background Art

10 **[0002]** Lubricating oil for shock absorbers in automobiles is employed mainly for damping vibration in order to attain optimum attenuation force and maintain driving stability. Generally, shock absorbers are disposed in an automobile between the body and the tires and attenuate vibration of the car body caused by bumps of a road, jolting generated at quick acceleration or heavy braking, and other motions.

15 **[0003]** Hitherto, lubricating oils for shock absorbers in automobiles have exhibited enhanced vibration damping effect through reducing the friction at a sliding interface between an oil seal and a piston rod, a piston rod and a guide bush, a piston band and a cylinder, etc. in a shock absorber (see, for example, Patent Documents 1 and 2).

[0004] Patent Document 3 discloses a lubricating oil composition containing a base oil and at least one species selected from among an alkenyl succinimide, an acidic phosphite diester, and a perbasic sulfonate, phenate, or salicylate of an alkaline earth metal, for the purposes of enhancing frictional force at the interface between an oil seal and a piston rod, reducing the friction coefficient between the piston rod and the guide bush, and suppressing foaming.

20 **[0005]** Generally, a shock absorber is arranged not in a direction orthogonal to the road but is slanted from the orthogonal direction, since the slant arrangement provides more excellent riding comfort. Thus, during expansion and contraction of a shock absorber, large lateral force attributed to a generated bending moment is applied to the shock absorber. In order to facilitate expansion and contraction of the shock absorber under application of lateral force, a shock absorber oil (shock absorber fluid: SAF) is required to reduce friction of a bearing (guide bush). Particularly when the guide bush of a shock absorber has worn, oil leakage occurs, thereby failing to gain appropriate attenuation power, which is problematic.

25 **[0006]** As described above, the piston rod/guide bush friction has been reduced by use of a phosphorus-containing additive or a fatty acid. However, phosphorus-containing additives generally have poor thermal stability, and fatty acids generally have poor wear resistance.

Prior Art Documents

35 Patent Documents

[0007]

40 Patent Document 1: Japanese Patent Application Laid-Open (*kokai*) No. Hei 5-255683
 Patent Document 2: Japanese Patent Application Laid-Open (*kokai*) No. 2000-192067
 Patent Document 3: Japanese Patent Application Laid-Open (*kokai*) No. 2009-298886

Summary of the Invention

45 Problems to be Solved by the Invention

[0008] Under such circumstances, an object of the present invention is to provide a lubricating oil composition for a shock absorber that can improve lubricity between bronze and chromium, which are materials generally used in a guide bush and a piston rod; specifically, the composition lowers the friction coefficient therebetween and reduces wear area of bronze, to thereby reduce the friction coefficient between a piston rod and a guide bush and, furthermore, to prevent wearing of the guide bush.

Means for Solving the Problems

55 **[0009]** The present inventor has conducted extensive studies to develop a lubricating oil composition for solving the aforementioned problems, and has found that the object can be attained by adding a specific amount of a specific polyhydric alcohol partial ester to a specific base oil. The present invention has been accomplished on the basis of this finding.

[0010] Accordingly, the present invention provides the following.

[1] A lubricating oil composition for a shock absorber, comprising:

- (A) a base oil composed of a mineral oil and/or a synthetic oil, and;
 (B) a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue, in an amount of 0.05 mass% to 10 mass%, with respect to the total amount of the composition.

[2] A lubricating oil composition for a shock absorber as described in [1] above, wherein the component (B) is a tetrahydric alcohol partial ester.

[3] A lubricating oil composition for a shock absorber as described in [1] or [2] above, wherein the component (B) is pentaerythritol dioleate and/or pentaerythritol dilaurylate.

[4] A lubricating oil composition for a shock absorber as described in any of [1] to [3] above, which further comprises (C) a phosphorus-containing compound.

Effects of the Invention

[0011] According to the present invention, there can be provided a lubricating oil composition for a shock absorber that can improve lubricity between bronze and chromium, which are materials generally used in a guide bush and a piston rod; specifically, the composition lowers the friction coefficient therebetween and reduces wear area of bronze, to thereby reduce the friction coefficient between a piston rod and a guide bush and, furthermore, to prevent wearing of the guide bush. Particularly, the lubricating oil composition for a shock absorber of the present invention can provide automobile users with excellent riding comfort through reduction in friction coefficient. Furthermore, the lubricating oil composition of the present invention prevents friction in a shock absorber, to thereby enhance durability of the shock absorber, whereby the shock absorber can exhibit excellent riding comfort and high durability.

Modes for Carrying Out the Invention

[0012] The lubricating oil composition for a shock absorber of the present invention comprises;

- (A) a base oil composed of a mineral oil and/or a synthetic oil (hereinafter may be referred to simply as "component (A)"), and;
 (B) a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue (hereinafter may be referred to simply as "component (B)"), in an amount of 0.05 mass% to 10 mass% with respect to the total amount of the composition.

<(A) Base oil>

[0013] The base oil (A) of the lubricating oil composition of the present invention is a mineral oil and/or a synthetic oil. No particular limitation is imposed on the type of the mineral oil and synthetic oil. Examples of the mineral oil include paraffin-based mineral oil, intermediate mineral oil, and naphthene-based mineral oil, which are produced through a routine refining method such as solvent refining or hydrogenation refining.

[0014] Examples of the synthetic oil include polybutene, polyolefins [e.g., α -olefin (co)polymers], esters (e.g., polyol-esters, dibasic acid esters, and phosphoric acid esters), and ethers (e.g., polyphenyl ether), alkylbenzenes, and alkyl-naphthalenes.

[0015] In the present invention, the mineral oil may be used, as the base oil, singly or in combination of two or more species. Also, the synthetic oil may be used, as the base oil, singly or in combination of two or more species. Furthermore, one or more mineral oils may be combined with one or more synthetic oils.

[0016] Among these oils, mineral oils, particularly paraffin-based mineral oils; α -olefin polymers, such as 1-decene oligomers; and mixtures thereof are preferably employed.

[0017] The lubricating oil composition of the present invention is mainly employed as an automobile shock absorber oil. Thus, the viscosity of the base oil is preferably within the range of 2 to 20 mm²/s, more preferably 3 to 15 mm²/s, and still more preferably 4 to 10 mm²/s in terms of kinematic viscosity at 40°C.

[0018] No particular limitation is imposed on the viscosity index of the base oil, but it is preferably 95 or higher, more preferably 100 or higher, still more preferably 105 or higher. In the case where a plurality of base oils are used in combination, properties of the base oils including viscosity index mean those of the base oil mixture.

[0019] The base oil preferably has a flash point of 150°C or higher, more preferably 155°C or higher. When the flash point of the base oil is 150°C or higher, foaming is suppressed in use of the oil composition, which may enhance riding comfort.

[0020] Therefore, it is not preferred to use a base oil to which an excessive amount of low-viscosity base has been added for the purpose of enhancement of low-temperature flowability.

[0021] In the present invention, the flash point is generally measured through JIS K2265 (COC method).

[0022] No particular limitation is imposed on the component (A) content of the lubricating oil composition of the present invention. For example, the component (A) content is preferably 50 mass% to 99.9 mass%, with respect to the total amount of the composition, more preferably 70 mass% to 99.8 mass%, still more preferably 80 mass% to 99.7 mass%.

<(B) Polyhydric alcohol partial ester>

[0023] Component (B) is a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue. As used herein, the term "fatty acid residue" refers to a residue formed through removal of a carboxyl group from a fatty acid.

[0024] No particular limitation is imposed on the fatty acid residue, and the residue may be branched or linear-chain, or may be an unsaturated aliphatic hydrocarbon residue or a saturated aliphatic hydrocarbon residue. Specific examples of the fatty acid residue include decyl, lauryl, palmityl, stearyl, and oleyl.

[0025] Examples of the polyhydric alcohol include dihydric alcohols, such as ethylene glycol, diethylene glycol, propylene glycol, and dipropylene glycol; trihydric alcohols, such as glycerin, trimethylolethane, trimethylolpropane, trimethylolbutane, 1,3,5-pentanetriol, 1,2,4-butanetriol, 1,2,6-hexanetriol; tetrahydric alcohols, such as pentaerythritol, 1,2,3,4-butanetetrol, and sorbitan; and polyhydric alcohols, such as adonitol, arabitol, xylytol, sorbitol, and mannitol.

[0026] No particular limitation is imposed on the valency of the polyhydric alcohol, but the number of hydroxyl groups is preferably 3 or more, more preferably 4.

[0027] The polyhydric alcohol preferably has 1 to 3 ester substituted sites, more preferably 2 to 3 ester substituted sites.

[0028] The polyhydric alcohol partial ester preferably has 2 or more hydroxyl groups.

[0029] Examples of preferred polyhydric alcohol partial esters include pentaerythritol dioleate, pentaerythritol dilaurylate, and pentaerythritol distearyl.

[0030] Of these, pentaerythritol dioleate and pentaerythritol dilaurylate are particularly preferred.

[0031] The component (B) content of the lubricating oil composition of the present invention is 0.05 mass% to 10 mass%, with respect to the total amount of the composition, preferably 0.2 mass% to 4 mass%, more preferably 0.3 mass% to 3 mass%.

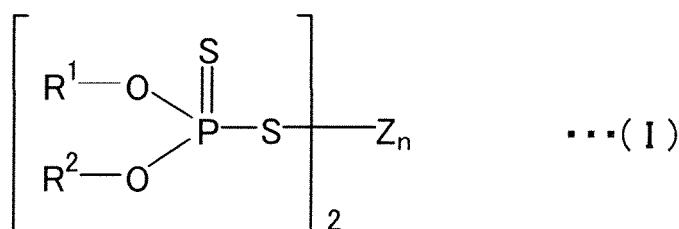
<(C) Phosphorus-containing compound>

[0032] The lubricating oil composition of the present invention preferably contains (C) a phosphorus-containing compound (hereinafter may be referred to simply as "component (C)"). The phosphorus-containing compound exerts synergistically with polyhydric alcohol partial ester (B), to thereby provide considerably enhanced wear resistance.

[0033] Examples of the phosphorus-containing compound (C) include phospho-ester compounds such as a phosphate ester, an acidic phosphate monoester amine salt, and an acidic phosphite diester, and zinc dithiophosphate (ZnDTP).

[0034] The lubricating oil composition of the present invention preferably contains, as a phosphorus-containing compound among them, ZnDTP having a C7 to C12 alkyl group. Examples of the ZnDTP includes compounds represented by the following formula (I)

[F1]



(wherein each of R¹ and R² represents a C7 to C12 linear-chain, branched, or cyclic alkyl group).

[0035] Specific examples of the alkyl group R¹ or R² in formula (I) include heptyl, isoheptyl, cyclohexylmethyl, octyl, 2-ethylhexyl, isooctyl, cyclooctyl, nonyl, isononyl, 3,5,5-trimethylhexyl, cyclooctylmethyl, decyl, 3,7-dimethyloctyl, 2-propylheptyl, isodecyl, undecyl, dodecyl, 2-butyloctyl, and isododecyl. Among them, C7 to C10 alkyl groups are more preferred.

[0036] R¹ and R² may be identical to or different from each other. However, they are preferably the same group, from the viewpoint of easiness of production.

[0037] Examples of the phosphate ester compound include an acidic phosphoric acid monoester amine salt formed from an acidic phosphoric acid monoester having a C1 to C8 alkyl or alkenyl group; e.g., monomethyl hydrogenphosphate or monoethyl hydrogenphosphate, and an amine compound having a C8 to C20 alkyl or alkenyl group.

[0038] The lubricating oil composition of the present invention preferably has a component (C) content; i.e., a phosphorus-containing compound content, of 0.3 to 2 mass%, with respect to the total amount of the composition, more preferably 0.5 to 1.5 mass%.

<Other optional components>

[0039] So long as the object of the present invention is not impaired, the shock absorber oil of the present invention may appropriately contain, as an optional additive, at least one species selected from among an ashless detergent-dispersant, a metallic detergent, a lubrication improver, an antioxidant, a rust preventive, a metal deactivator, a viscosity index improver, a pour point depressant, and a defoaming agent. No particular limitation is imposed on the optional components, and the amounts of these components are preferably 0.1 to 20 mass%, with respect to the total amount of the composition, more preferably 0.3 to 10 mass%, still more preferably 0.3 to 5 mass%.

[0040] Examples of the ashless detergent-dispersant include divalent carboxamides, such as a succinimide, a boron-containing succinimide, a benzylamine, a boron-containing benzylamine, and succinic acid. Examples of the metallic detergent include a neutral metal sulfonate, a neutral metal phenate, a neutral metal salicylate, a neutral metal phosphonate, a basic sulfonate, a basic phenate, a basic salicylate, a perbasic sulfonate, a perbasic salicylate, and a perbasic phosphonate.

[0041] Examples of the type of the lubrication improver include an extreme pressure agent, an antiwear agent, and an oiliness agent, and examples of the material of the lubrication improver include organometallic compounds, such as zinc dithiocarbamate (ZnDTC), oxysulfidomolybdenum organophosphorodithioate (MoDTP), and oxysulfidomolybdenum dithiocarbamate (MoDTC).

[0042] Examples of the sulfur-containing extreme pressure agent include sulfurized oils, sulfurized fatty acids, sulfurized esters, sulfurized olefins, dihydrocarbyl polysulfide, thiadiazole compounds, alkylthiocarbamoyl compounds, triazine compounds, thioterpenes, and dialkylthio dipropionate compounds.

[0043] Examples of the oiliness agent include aliphatic saturated and unsaturated monocarboxylic acids, such as stearic acid and oleic acid; polymerized fatty acids, such as dimer acid and hydrogenated dimer acid; hydroxy fatty acids, such as ricinoleic acid and 12-hydroxystearic acid; aliphatic saturated and unsaturated monoalcohols, such as lauryl alcohol and oleyl alcohol; aliphatic saturated and unsaturated monoamines, such as stearylamine and oleylamine; and aliphatic saturated and unsaturated monocarboxamides, such as lauriamide and oleamide.

[0044] Examples of the antioxidant include polycyclic phenol-based antioxidants, such as 4,4'-methylenebis(2,6-di-tert-butylphenol) and 2,2'-methylenebis(4-ethyl-6-tert-butylphenol); amine-based antioxidants, such as monoalkyldiphenylamine compounds; e.g., mono-octyldiphenylamine and monononyldiphenylamine, dialkyldiphenylamine compounds; e.g., 4,4'-dibutyldiphenylamine, 4,4'-dipentyldiphenylamine, 4,4'-dihexyldiphenylamine, 4,4'-diheptyldiphenylamine, 4,4'-dioctyldiphenylamine, and 4,4'-dinonyldiphenylamine, polyalkyldiphenylamine compounds; e.g., tetrabutyl-diphenylamine, tetrahexyldiphenylamine, tetraoctyldiphenylamine, and tetranonyldiphenylamine, and naphthylamine compounds; e.g., α -naphthylamine, phenyl- α -naphthylamine, butylphenyl- α -naphthylamine, pentylphenyl- α -naphthylamine, hexylphenyl- α -naphthylamine, heptylphenyl- α -naphthylamine, octylphenyl- α -naphthylamine, and nonylphenyl- α -naphthylamine; and sulfur-containing antioxidants such as thioterpenes; e.g., 2,6-di-tert-butyl-4-(4,6-bis(octylthio)-1,3,5-triazin-2-ylamino)phenol and a reaction product between phosphorus pentasulfide and pinene, and dialkyl thiodipropionates; e.g., dilauryl thiodipropionate and distearyl thiodipropionate.

[0045] Examples of the rust preventive include metal sulfonates and succinate esters. Examples of the metal deactivator include benzotriazole and thiadiazole.

[0046] Examples of the viscosity index improver include polymethacrylates, dispersed polymethacrylates, olefin copolymers (e.g., ethylene-propylene copolymer), dispersed olefin copolymers, and styrene copolymers such as (e.g., styrene-diene hydrogenated copolymer).

[0047] Examples of the pour point depressant which may be used in the invention include polymethacrylates having a mass average molecular weight of about 50,000 to about 150,000.

[0048] The defoaming agent is preferably a silicone polymer-based defoaming agent. Through incorporation of the silicone polymer-based defoaming agent, defoaming performance can be effectively attained, whereby riding comfort can be improved.

[0049] Examples of the silicone polymer-based defoaming agent include organopolysiloxanes. Among them, fluorine-containing organopolysiloxanes such as trifluoropropylmethylsilicone oil are particularly preferred.

[0050] The lubricating oil composition of the present invention may be applied to any of a multi-cylinder shock absorber

and a single-cylinder shock absorber, and shock absorbers of a four-wheeled vehicle or a two-wheeled vehicle. The composition of the present invention is particularly suitably used in four-wheeled vehicles.

[0051] Particularly, the lubricating oil composition of the present invention lowers friction coefficient at the interface between bronze and chromium and reduces wear area of bronze. Thus, the composition of the present invention is suitably used as a lubricant for a shock absorber which has a guide bush at least including a bronze surface, and a piston rod at least including a sliding part which comes into contact with the guide bush and which is made of chromium (e.g., chromium plating).

Examples

[0052] The present invention will next be described in more detail by way of examples, which should not be construed as limiting the invention thereto.

[0053] Measurement of friction coefficient and a wear test were carried out through the following procedures.

(1) Measurement of bronze-chromium friction coefficient

Tester: Bowden-type reciprocating kinetic friction tester

Test conditions:

Load: 0.5 kgf
Stroke: 10 mm
Speed: 0.2 mm/s
Temperature: 80°C
Friction operation: once
Friction members
Upper friction member: phosphor bronze ball
Lower friction member: chromium-plated sheet
(50 x 1,000 x 5 mm)

In a specific procedure, a 1/2-inch phosphor bronze was used. An oil composition sample was supplied to a plate, in an amount corresponding to several drops. The ball was conditioned on the plate (8 mm/s, 0.1 kgf for 2 minutes, 0.2 kgf for 2 minutes, 0.3 kgf for 2 minutes, and 0.5 kgf for 2 minutes). Thereafter, the wear test was performed at 0.2 mm/s.

(2) Wear test of bronze surface (wear area)

Tester: Bowden-type reciprocating kinetic friction tester

Test conditions:

Load: 0.5 kgf
Stroke: 10 mm
Speed: 8.0 mm/s
Temperature: 80°C
Friction time: 30 minutes
Friction members
Upper friction member: phosphor bronze ball
Lower friction member: chromium-plated sheet
(50 x 1,000 x 5 mm)

[0054] In the wear test, a 1/2-inch phosphor bronze was used. An oil composition sample was supplied to a plate, in an amount corresponding to several drops. The wear area of the phosphor bronze ball was measured.

Examples 1 to 6, and Comparative Examples 1 to 4

[0055] Lubricating oil compositions (shock absorber oils) containing the components given in Table 1 were prepared. Each composition was subjected to the friction coefficient measurement and the wear test. Table 1 shows the results.

[0056] [Table 1]

Table 1

Examples/Comparative Examples	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4
	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4
Component (mass%)	(A)	Base oil	99.50	90.00	0.50	99.50	99.90	99.50	99.50	99.50
	(B) + α	Pentaerythritol dioleate	0.50	0.50		5.00				
		Pentaerythritol dilaurate								
		Pentaerythritol monooleate			0.50					
		Pentaerythritol tetraoleate					0.50			
		Stearic acid						0.50		
		Methyl acid phosphate amine salt								0.50
Test results	(C)	Zn-DTP(pri) C8-C10		0.50					0.50	
		Friction coefficient	0.093	0.105	0.097	0.112	0.115	0.096	0.084	0.179
		Wear area (mm ²)	0.176	0.124	0.188	0.203	0.241	0.263	0.550	0.193

[0057] The components used in the Examples and Comparative Examples shown in Table 1 are as follows.

Base oil : secondary hydro-reformed mineral oil (paraffin-base) having a kinematic viscosity of 7.83 mm²/s measured at 40°C

Pentaerythritol dioleate: UNISTER H481D, product of NOF Corporation

Pentaerythritol monooleate: EKISUPARU PE-MO

Pentaerythritol tetraoleate: UNISTER H481R, product of NOF Corporation

Methyl acid phosphate amine salt: VANLUBE 672, product of Vanderbilt

Zn-DTP(pri): OLOA 5286, C8 to C10 mixed alkyl groups, product of Ethyl Corporation

[0058] According the oil compositions of the Examples, each containing (A) a base oil composed of a mineral oil and/or a synthetic oil and a specific amount of (B) a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue, friction coefficient and wear area were found to be reduced. Particularly in the case of the oil composition of Example 2, containing component (B) and component (C), wear area was considerably reduced.

[0059] In Comparative Example 1, employing a complete ester of a polyhydric alcohol, friction coefficient and wear area were at high levels. In Comparative Example 2, employing stearic acid, friction coefficient was low, but wear area was large. In Comparative Example 3, employing ZnDTP instead of component (B), friction coefficient and wear area were at high levels. In Comparative Example 4, employing a phosphate amine salt, friction coefficient was higher than that obtained in the Examples.

Industrial Applicability

[0060] The lubricating oil composition of the present invention can be used for automobile shock absorbers. The composition is applicable to both four-wheeled vehicles and two-wheeled vehicles.

Claims

1. A lubricating oil composition for a shock absorber, comprising:

(A) a base oil composed of a mineral oil and/or a synthetic oil, and;

(B) a polyhydric alcohol partial ester having a C10 to C20 fatty acid residue, in an amount of 0.05 mass% to 10 mass%, with respect to the total amount of the composition.

2. A lubricating oil composition for a shock absorber according to claim 1, wherein the component (B) is a tetrahydric alcohol partial ester.

3. A lubricating oil composition for a shock absorber according to claim 1 or 2, wherein the component (B) is pentaerythritol dioleate and/or pentaerythritol dilaurylate.

4. A lubricating oil composition for a shock absorber according to any of claims 1 to 3, which further comprises (C) a phosphorus-containing compound.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/057811

A. CLASSIFICATION OF SUBJECT MATTER

C10M129/76(2006.01)i, C10M137/10(2006.01)n, C10N30/06(2006.01)n,
C10N40/06(2006.01)n

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)

C10M129/76, C10M137/10, C10N30/06, C10N40/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

JSTPlus/JMEDPlus/JST7580 (JDreamIII)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 6-145684 A (Tonen Corp.), 27 May 1994 (27.05.1994), claims; paragraph [0002]; examples (Family: none)	1, 4
X	JP 7-150176 A (Tonen Corp.), 13 June 1995 (13.06.1995), claims; paragraph [0001]; examples (Family: none)	1, 4
X	JP 9-176672 A (Tonen Corp.), 08 July 1997 (08.07.1997), claims; examples (Family: none)	1, 4

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
17 June, 2013 (17.06.13)

Date of mailing of the international search report
25 June, 2013 (25.06.13)

Name and mailing address of the ISA/
Japanese Patent Office

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/057811

C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 5-331477 A (Tonen Corp.), 14 December 1993 (14.12.1993), claims; paragraph [0002]; examples (Family: none)	1, 4
X	WO 2006/129888 A1 (Nippon Oil Corp.), 07 December 2006 (07.12.2006), claims; examples & JP 2006-335966 A & JP 2007-9200 A	1, 4
X	JP 2000-192067 A (Nippon Mitsubishi Oil Corp.), 11 July 2000 (11.07.2000), claims; paragraphs [0051] to [0053]; examples (Family: none)	1-4
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X Y	WO 2008/038571 A1 (Idemitsu Kosan Co., Ltd.), 03 April 2008 (03.04.2008), claims; paragraphs [0002], [0028], [0029], [0033]; examples & CN 101517054 A	1, 4 2, 3
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Y	JP 11-501969 A (Exxon Chemical Patents Inc.), 16 February 1999 (16.02.1999), claims; table 12 & US 5665686 A & WO 1996/028525 A1	2, 3

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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- JP 2009298886 A [0007]