

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization

International Bureau



WIPO | PCT



(10) International Publication Number

WO 2014/189734 A1

(43) International Publication Date

27 November 2014 (27.11.2014)

(51) International Patent Classification:

C08F 220/18 (2006.01) C08F 2/50 (2006.01)
C08F 220/26 (2006.01) C08J 5/00 (2006.01)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(21) International Application Number:

PCT/US2014/037970

(22) International Filing Date:

14 May 2014 (14.05.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

201310187526.0 20 May 2013 (20.05.2013) CN

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(71) Applicant: 3M INNOVATIVE PROPERTIES COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

(72) Inventors: YAO, Rongxia; 8 Xing Yi Road, Maxdo Center 38/F, Shanghai 200336 (CN). SUN, Yu; 8 Xing Yi Road, Maxdo Center 38/F, Shanghai 200336 (CN). WU, Qing; 8 Xing Yi Road, Maxdo Center 38/F, Shanghai 200336 (CN). TENG, Chao; 8 Xing Yi Road, Maxdo Center 38/F, Shanghai 200336 (CN).

(74) Agents: ADAMSON, Trisha D. et al.; 3M Center, Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, Minnesota 55133-3427 (US).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))



WO 2014/189734 A1

(54) Title: CURABLE ACRYLIC COMPOSITION, ACRYLIC TAPE, ACRYLIC RUBBER ROLL AND METHOD FOR PREPARING THE ACRYLIC RUBBER ROLL

(57) Abstract: Disclosed is a curable acrylic composition, an acrylic tape, an acrylic rubber roll and a method for preparing the acrylic rubber roll. The acrylic composition contains 50-77 wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, 0.1-0.5wt% curing agent and 0.1-0.2wt% photoinitiator. The acrylic rubber roll formed by the acrylic composition can recover its viscosity if washed directly with clean water without cleanser, and is characterized by excellent cleaning ability and washability.

**CURABLE ACRYLIC COMPOSITION, ACRYLIC TAPE, ACRYLIC RUBBER ROLL AND
METHOD FOR PREPARING THE ACRYLIC RUBBER ROLL****Specification****5 Technical Field**

The present disclosure relates to a curable acrylic composition, an acrylic tape, an acrylic rubber roll and a method for preparing the acrylic rubber roll.

Background

10 At present, dedusting adhesive tapes and rubber rolls, also referred to as lint rollers, can be used to clean various surface. Disposable dedusting adhesive tapes and rubber rolls are easy to use but are relatively high in cost. Reusable and water washable dedusting rubber rolls have become increasingly popular among price-sensitive and environmentally conscious consumers. Most water washable adhesive cleaning rolls in the market are composed of base materials such as natural rubber, synthetic rubber, 15 silica gel or PVC, in which self-adhesive elastomer materials function as the adhesive layer and most of the surfaces are hydrophobic, resulting in unsatisfactory results when cleaning only with water, requiring cleansers or hot water to be when cleaning the rolls so as to reduce surface friction. Moreover, many cleansers are alkaline or acidic in nature and will cause damage to adhesive surfaces over long-term use. Therefore, using less or not using cleanser at all would be more in line with green, environmental 20 protection, and safe to touch with hands. In addition, most washable rolls commercially available are characterized by large surface friction and difficult rolling, and are thereby difficult to be satisfactorily cleaned, or can even cause detachment or breakage to the support shaft of rolls, affecting the performance.

25 Summary

In order to solve the existing technological problems, disclosed is a curable acrylic composition, and an acrylic tape made from a curable acrylic composition and acrylic rubber roll composing said acrylic tape, wherein the acrylic rubber roll can recover its adhesion if washed with clean water without cleansers and is characterized by excellent cleaning ability and washability.

30 Compared with conventional reusable and washable rubber rolls, the embodiment of the present disclosure has great advantages. The acrylic rubber roll can recover its adhesion if directly washed with clean water without cleansers, and is characterized by excellent cleaning ability and washability, easy cleaning of soft surfaces, and removal of lint, dandruff, dust, bits of thread, and so on that are attached to soft surfaces of household textile products, thus lowering the frequency for cleaning household textile 35 products, especially clothing. A particular benefit is that in the acrylic rubber roll disclosed, the surface loses adhesion and becomes smooth when exposed to water, and the dirt attached to the surface can be easily removed with water without cleansers, and the acrylic composition can recover its viscosity after removing the moisture on the surface, and can be reused, reducing environmental pollution. After being reused many times, the acrylic rubber roll is still provided with good adhesion and rubber surface 40 appearance, wherein the rubber surface is well bonded with the attached plastic roll, and the rubber

surface is less likely to be detached if washed with water.

In one embodiment, a curable acrylic composition is provided, which comprises 50-77wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, 0.1-0.5wt% curing agent and 0.1-0.2wt% photoinitiator.

5 In one embodiment, the photoinitiator includes 2,2-dimethoxy-phenyl ketone.

In one embodiment, said curing agent is bifunctional acrylic ester. The bifunctional acrylic ester can include HDDA or TPGDA.

In one embodiment, the acrylic composition also includes one or more of: antiseptic, antibacterial agent, flavoring agent, plasticizer and fumed silica.

10 One embodiment provides an acrylic tape formed by curing said acrylic composition.

In one embodiment, said curing includes UV light curing.

One embodiment provides an acrylic rubber roll comprising a roll and said acrylic tape wrapped on the roll.

15 One embodiment provides a method for producing acrylic rubber rolls, which includes: mixing and stirring 50-77wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, and 0.1-0.5wt% curing agent at room temperature; adding 0.1-0.2wt% photoinitiator into the mixture, and continuing to stir until the photoinitiator is fully dissolved to form the acrylic composition; irradiating the acrylic composition with UV-light to make it crosslink and cure to obtain an acrylic tape; cutting the acrylic tape model corresponding to the size of plastic rubber roll shaft, and sticking said acrylic tape evenly without air bubbles to the rubber roll that can rotate freely so as to get said acrylic rubber roll.

20

In the embodiment of method for producing the acrylic rubber roll, before irradiating the acrylic composition with UV-light, one or more antiseptic, antibacterial agent, flavoring agent, flavoring agent and fumed silica will be added into the acrylic composition.

25 In the embodiment of method for producing acrylic rubber rolls, the stated curing agent includes bifunctional acrylic ester.

In the embodiment of method for producing acrylic rubber rolls, the photoinitiator comprises 2,2-dimethoxy-phenyl ketone.

Detailed Description

30 In one embodiment, a curable acrylic composition is provided, comprising 50-77wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, 0.1-0.5wt% curing agent and 0.1-0.2wt% photoinitiator.

The acrylic composition also comprises other additive such as mildew preventive, antibacterial agent and flavoring agent, such as fumed silica and A-200.

35 The curing agent has no special restrictions. The embodiment of the curing agent can include a bifunctional acrylic ester monomer such as HDDA and TPGDA.

The photoinitiator has no special restrictions. For example, the embodiment of the photoinitiator can be

Irgacure 651.

The curable acrylic composition in the embodiment of the disclosure is formed by mixing 2-ethylhexyl acrylate, acrylic acid, 2-hydroxyethyl acrylate, curing agent and photoinitiator according to ratios.

In addition, the acrylic tape can be formed by curing the curable acrylic composition. UV-light can be
5 used for curing.

In one embodiment, the acrylic rubber roll can be formed by wrapping the acrylic tape on the roll. The acrylic rubber roll can be used to clean surfaces of household textile products.

In one embodiment, acrylic composition can be applied on the roll, and then be crosslinked and cured to form the acrylic rubber roll used to clean surfaces of household textile products.

10

Examples

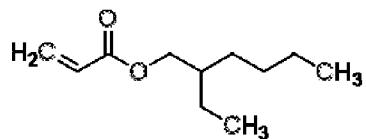
The embodiment of the present disclosure is described by, but not limited to the following embodiments.

Typical raw materials used in embodiments and comparison cases are listed as follows:

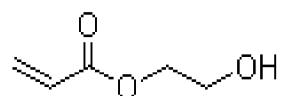
	2-EHA	AA	HEA	Irgacure 651	HDDA
Supplier	HYAYL	BASF	BASF	Ciba	Cytec
Type	2-ethylhexyl acrylate	Acrylic acid	2-Hydroxyethyl acrylate	Photoinitiator	Curing agent
Case No.	103-11-7	79-10-7	818-61-1	24650-42-8	13048-33-4

15

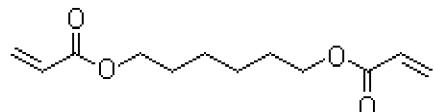
1) Structure of 2-EHA



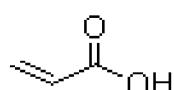
2) Structure of HEA



3) Structure of HDDA

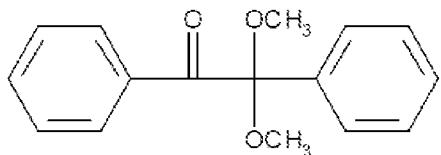


4) Structure of AA



20

5) Structure of Irgacure 651 (2,2-dimethoxy-phenyl ketone)

**Embodiment 1**

Homogeneously mix 2-EHA, AA, HEA, the curing agent HDDA and the Photoinitiator Irgacure 651 according to the ratios shown in Table 1 to obtain the curable acrylic composition. Specifically, pour

5 liquid raw materials including 2-EHA, AA, HEA and the curing agent HDDA into a glass container at room temperature, stir said materials at a constant speed with a stirrer, then add photoinitiator Irgacure 651 powder and continue to stir said materials at a constant speed until the photoinitiator Irgacure 651 is completely dissolved.

10 Cure and crosslink the acrylic composition with a UV lamp and ensure the crosslinking reaction of monomers in the formula is thorough so as to form the acrylic tape.

Cut the acrylic tape model to the size of the plastic rubber roll shaft, and stick said acrylic tape evenly without air bubbles to the rubber roll that can rotate freely so as to form the acrylic rubber roll that can be used to remove dust and lint.

15 Comparison Cases 1-2

A curable acrylic composition can be prepared with the same method in Embodiment 1. The difference lies in changing the ratios of **2-EHA, AA and HEA** as shown in Table 1. Prepare the acrylic tape and the acrylic rubber roll with the curable acrylic composition prepared with same method in Embodiment 1.

20 Embodiments 2-4

Prepare the curable acrylic composition with the same method in Embodiment 1. The difference lies in changing the ratios of **2-EHA, AA and HEA** as shown in Table 1. Prepare the acrylic tape and the acrylic rubber roll with the curable acrylic composition prepared with the same method in Embodiment 1.

Table 1

Sample	2-EHA (wt%)	AA (wt%)	HEA (wt%)	HDDA (wt%)	Irgacure 651 (wt%)
Embodiment - 1	56.5	3	40	0.3	0.2
Comparison Case - 1	76.5	4	19	0.3	0.2
Embodiment - 2	75.5	4	20	0.3	0.2
Embodiment - 3	53.5	6	40	0.3	0.2
Comparison Case - 2	72.5	8	19	0.3	0.2
Embodiment - 4	71.5	8	20	0.3	0.2

The acrylic tape and the acrylic rubber roll prepared in the embodiments and comparison cases are tested. The testing methods are as follows:

5 **Washing Test Method:**

Select a suitable amount of lint and lay said lint on a flat surface. Gently contact the tested fresh rubber-surface with the lint and then quickly lift the sample up. Observe whether or not the lint is easily picked up by the rubber sample.

10 Place the rubber sample, now stuck with lint, under a faucet and wash the rubber surface with slow running water, gently wiping the lint off the adhesive surface with fingers. Keep the washing time controlled to 15 seconds or less. Turn off the tap and observe whether any lint remains on the adhesive surface.

The results obtained from this test are shown in Table 2.

Table 2- Results of Washing Test

Sample	Appearance	Result
Embodiment -1	Good transmittance, mildly hard rubber without air bubbles	Easy to wash, no remaining lint
Comparison Case -1	Good transmittance, soft rubber without air bubbles	Hard to wash, remaining lint.
Embodiment - 2	Good transmittance, soft rubber without air bubbles	Easy to wash, no remaining lint
Embodiment - 3	Good transmittance, mildly hard rubber without air bubbles	Easy to wash, no remaining lint

Comparison Case - 2	Good transmittance, soft rubber without air bubbles	Hard to wash, remaining lint.
Embodiment - 4	Good transmittance, soft rubber without air bubbles	Easy to wash, no remaining lint

Initial Adhesion Test Method:

Refer to the standards of G1 ASTM D6195 for the initial adhesion test method. The samples include the fresh rubber samples and soaked rubber samples. The method for preparing soaked samples is to soak the 5 whole rubber sample in clean water and remove after 30 minutes of soaking. Place the rubber sample in a room at 22°C and humidity of 50% until the rubber sample is completely dry for testing.

The results obtained from this test are shown in Table 3.

Table 3- Results of Initial Adhesion Test:

Sample	Fresh sample (N/inch)	Soaked sample (N/inch)
Embodiment -1	19.31	11.32
Comparison Case -1	15	7.36
Embodiment -2	18.97	9.44
Embodiment -3	16.26	9.2
Comparison Case-2	14.32	5.6
Embodiment -4	18.92	7.4

10

In the practical application of washable rubber rolls, initial adhesion is one of the most direct indexes indicating roll performance. Since concepts such as washing and reusability are involved in use, the initial adhesion retention of soaked rubber samples is important too. With initial adhesion tests on fresh samples and soaked samples, the performance of washable rubber rolls in practical applications can be simulated.

15 In practical applications, too great or small initial adhesion will affect practical using effects. According to test results, Embodiment-1, Embodiment-2 and Embodiment-3 have excellent initial adhesion retention, washing test results and initial adhesion test results for fresh samples and soaked samples.

Washability Test:

20 The test sample measures 1 inch by 8 inches and is covered with standard dust. The sample is washed by hand with running water for about 15 seconds, then the water droplets are gently shaken off and the

sample is allowed to stand for one minute in a 22°C and 50% relative humidity environment. These steps are then repeated (dusting, cleaning, and rinsing) 150 times before being allowed to dry for 5 minutes. Then testing is performed on Embodiment-1, Comparison Case-1 and competing products (competing products are mostly produced by casting elastic materials such as synthetic rubber, polyurethane, and 5 silica gel on a plastic roll shaft with a mould, and have names such as Sticky Lint Roller and Lint Cleaner, etc.) in accordance with G1 ASTM D6195.

After 150 cycles, the initial adhesion of Embodiment-1 remained nearly the same while that the competing products fell by about 50%. In addition, the initial adhesion of the rubber tape of Embodiment-1 is about 4 times greater than that of the competing product. The rubber tape of the 10 embodiment of the present disclosure has long-lasting cleaning abilities for adhered dirt such as dust and lint. Compared with Embodiment-1, the washability data of the Comparison Case-1 falls off slightly.

Table-4 Comparison Test on Washability

Comparison of initial adhesion, Unit: g/in, loop tack test method	Embodiment 1	Competing Product
Initial value (before rinsing)	272.4	67.34
After being used and rinsed 150 times	263.26	35.71

Test of the Recovery Time of Adhesion

The roll diameter of the rubber roller is 56mm and the roll is 98mm long. The natural dry time after 15 washing is the adhesion recovery time of the rubber roll.

Table 5- Adhesion Recovery Time

Natural dry time after washing	
	Natural dry time of rubber roll (min)
1#	19.0
2#	17.0
3#	22.0
4#	13.0
5#	18.0
Average dry time (min.)	17.8

In Table 5, 1#-5# are the 5 times sampling test results of Embodiment 1.

During practical application, consumers can reuse the rubber tape about 1 to 3 minutes later after the

rubber tape surface is half dry. The adhesion is sufficient to remove dirt such as lint. The rubber tape can be used before the rubber surface is completely dry. Wiping away water drops with a piece of soft cloth or paper that does not leave scraps to speed up the adhesion recovery of rubber surface.

5 Test Results on Washing Difficulty

Table 6

	With cold running water	With warm water	With soapy water
Embodiment 1	Easy to wash	Easy to wash	Easy to wash
Comparison Case 1	Difficult to wash	Easy to wash	Easy to wash
Competing Product	Difficult to wash	Difficult to wash	Easy to wash

What is claimed is:

1. A curable acrylic composition comprising 50-77 wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, 0.1-0.5wt% curing agent and 0.1-0.2wt% photoinitiator.
2. The acrylic composition according to Claim 1, wherein the curing agent comprises a 5 bifunctional acrylic ester.
3. The acrylic composition according to Claim 1, wherein the photoinitiator comprises 2,2-dimethoxy-phenyl ketone.
4. The acrylic composition according to Claim 2, wherein the bifunctional acrylic ester comprises HDDA or TPGDA.
- 10 5. The acrylic composition according to any of Claims 1 to 4, wherein the acrylic composition also comprises one or more of: antiseptic, antibacterial agent, flavoring agent, plasticizer and fumed silica.
6. An acrylic tape formed by curing the acrylic composition according to Claim 1.
7. The acrylic tape according to Claim 6, wherein the curing comprises ultraviolet (UV) light 15 polymerization.
8. An acrylic rubber roll comprising a roller and acrylic tape according to Claim 6 which is wrapped on the roller.
9. A method for preparing acrylic rubber roll, comprising:
 - mixing and stirring 50-77wt% 2-ethylhexyl acrylate, 2-10wt% acrylic acid, 20-40wt% 2-hydroxyethyl acrylate, and 0.1-0.5wt% curing agent at room temperature;
 - 20 adding 0.1-0.2wt% photoinitiator into the mixture, and continuing to stir until the photoinitiator is fully dissolved in order to form the acrylic composition;
 - irradiating said acrylic composition with UV light to make it crosslink and cure in order to obtain an acrylic tape;
 - 25 cutting the acrylic tape model according to the size of plastic rubber roll shaft, and evenly sticking said acrylic tape to the freely-rotatable rubber roll while avoiding air bubbles so as to obtain said acrylic rubber roll.
10. The method for producing the acrylic rubber roll according to Claim 9, additionally comprising:
 - before irradiating the acrylic composition with UV light, adding one or more of: antiseptic, 30 antibacterial agent, flavoring agent, plasticizer, and fumed silica into said acrylic composition.
11. The method for producing the acrylic rubber roll according to Claim 9, wherein the curing agent also comprises a bifunctional acrylic ester.
12. The method for producing acrylic rubber roll according to Claim 9, wherein the photoinitiator comprises 2,2-dimethoxy-phenyl ketone.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/037970

A. CLASSIFICATION OF SUBJECT MATTER

C08F 220/18(2006.01)i, C08F 220/26(2006.01)i, C08F 2/50(2006.01)i, C08J 5/00(2006.01)i

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)

C08F 220/18; C08G 2/00; A47L 13/26; C08F 2/50; C09J 133/08; C08F 2/46; A47L 13/12; B32B 7/12; C08F 220/26; C08J 5/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: curable, acrylate, rubber roll

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0142408 A1 (LIU, Y. et al.) 29 June 2006 See abstract; paragraphs [0049], [0051], [0056]-[0061]; and claims 7, 16, 17.	1-7
Y		8-12
Y	US 3754991 A (AMOS, H. C. et al.) 28 August 1973 See abstract; column 1, line 55-column 2, line 60; claim 1; and figure 1.	8-12
A	US 2011-0028583 A1 (SMITH, T. M. et al.) 03 February 2011 See abstract; paragraphs [0012], [0013], [0028]; and claims 1, 10, 14.	1-12
A	US 2005-0182150 A1 (BAMBOROUGH, D. W. et al.) 18 August 2005 See abstract; paragraphs [0107], [0111]; and claims 1-15.	1-12
A	US 6735806 B2 (BLUM, R. D. et al.) 18 May 2004 See abstract; column 2, line 14-column 3, line 24; claim 1; and figure 1.	1-12

 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
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

15 September 2014 (15.09.2014)

Date of mailing of the international search report

16 September 2014 (16.09.2014)

Name and mailing address of the ISA/KR

International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701,
Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

KIM, Eun Hee

Telephone No. +82-42-481-5543



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0142408 A1	29/06/2006	AU 2005-244547 A1 CN 1796421 A CN 1796421 B CN 1796421 C EP 1676870 A1 JP 05021204 B2 JP 2006-188687 A KR 10-1245781 B1 KR 10-2006-0076218 A TW I372765 I US 7745505 B2	13/07/2006 05/07/2006 09/06/2010 05/07/2006 05/07/2006 05/09/2012 20/07/2006 20/03/2013 04/07/2006 21/09/2012 29/06/2010
US 3754991 A	28/08/1973	None	
US 2011-0028583 A1	03/02/2011	US 8242185 B2	14/08/2012
US 2005-0182150 A1	18/08/2005	AT 366292 T DE 602005001556 D1 DE 602005001556 T2 EP 1725626 A1 EP 1725626 B1 JP 2007-523979 A US 7238732 B2 WO 2005-080518 A1	15/07/2007 16/08/2007 13/03/2008 29/11/2006 04/07/2007 23/08/2007 03/07/2007 01/09/2005
US 6735806 B2	18/05/2004	AU 2000-49787 A1 AU 2000-49787 B2 AU 2001-14543 A1 AU 2001-286690 A8 AU 2001-86690 A1 AU 2002-16653 A1 AU 2002-368358 A1 AU 2002-368358 A8 AU 2003-213272 A1 AU 2003-234569 A1 AU 2003-234569 B2 AU 2003-287055 A1 AU 2003-287055 B2 AU 2003-290769 A1 AU 2004-207380 A1 AU 2004-207380 B2 AU 2005-272965 A1 AU 2005-272965 B2 CA 2372074 A1 CA 2372074 C CA 2427348 A1 CA 2455135 A1 CA 2485176 A1 CA 2485176 C	17/11/2000 08/04/2004 07/11/2001 13/03/2002 13/03/2002 21/05/2002 08/07/2004 15/06/2004 16/09/2003 02/12/2003 21/02/2008 04/05/2004 20/11/2008 15/06/2004 12/08/2004 09/04/2009 23/02/2006 16/07/2009 09/11/2000 26/09/2006 16/05/2002 14/02/2003 27/11/2003 15/12/2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		CA 2502095 A1	29/04/2004
		CA 2506028 A1	03/06/2004
		CA 2514113 A1	12/08/2004
		CA 2514113 C	22/06/2010
		CA 2517748 A1	09/11/2000
		CA 2517748 C	20/11/2007
		CA 2576339 A1	23/02/2006
		CA 2576339 C	21/06/2011
		CA 2581343 A1	30/03/2006
		CA 2677427 A1	27/11/2003
		CN 100508837 C	08/07/2009
		CN 100573631 C	23/12/2009
		CN 101019157 A	15/08/2007
		CN 101019157 C	15/08/2007
		CN 1236722 C	18/01/2006
		CN 1359274 A	17/07/2002
		CN 1496697 A	19/05/2004
		CN 1496697 C	19/05/2004
		CN 1501787 A	02/06/2004
		CN 1501787 C	02/06/2004
		CN 1668975 C	14/09/2005
		CN 1720555 A	11/01/2006
		CN 1720555 C	16/07/2008
		CN 1761984 A	19/04/2006
		CN 1761984 C	19/04/2006
		EP 1198194 A1	24/04/2002
		EP 1308120 A2	07/05/2003
		EP 1308120 A3	07/04/2004
		EP 1308120 B1	06/08/2008
		EP 1339309 A2	03/09/2003
		EP 1506452 A1	16/02/2005
		EP 1538964 A2	15/06/2005
		EP 1559079 A2	03/08/2005
		EP 1559079 A4	06/08/2008
		EP 1586083 A2	19/10/2005
		EP 1779342 A1	02/05/2007
		EP 1792285 A1	06/06/2007
		GB 2363328 A	19/12/2001
		GB 2384703 A	06/08/2003
		GB 2386833 A	01/10/2003
		GB 2386834 A	01/10/2003
		JP 04361857 B2	11/11/2009
		JP 2002-542862 A	17/12/2002
		JP 2004-512890 A	30/04/2004
		JP 2005-526282 A	02/09/2005
		JP 2006-503341 A	26/01/2006
		JP 2006-518870 A	17/08/2006
		JP 2008-510184 A	03/04/2008
		KR 10-0454296 B1	26/10/2004
		KR 10-0537326 B1	16/12/2005

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		KR 10-0830196 B1	19/05/2008
		KR 10-2003-0048098 A	18/06/2003
		KR 10-2005-0050670 A	31/05/2005
		KR 10-2005-0088360 A	05/09/2005
		TW 277914 A	01/04/2007
		TW 277914 B	01/04/2007
		TW 493978 A	11/07/2002
		TW 493978 B	11/07/2002
		TW I277914 B	01/04/2007
		TW I302680 A	01/11/2008
		TW I302680 B	01/11/2008
		US 2001-0004483 A1	21/06/2001
		US 2001-0011399 A1	09/08/2001
		US 2002-0023308 A1	28/02/2002
		US 2002-0028313 A1	07/03/2002
		US 2002-0068147 A1	06/06/2002
		US 2002-0071936 A1	13/06/2002
		US 2002-0092110 A1	18/07/2002
		US 2002-0121985 A1	05/09/2002
		US 2002-0156634 A1	24/10/2002
		US 2003-0033681 A1	20/02/2003
		US 2003-0093870 A1	22/05/2003
		US 2003-0126708 A1	10/07/2003
		US 2003-0177679 A1	25/09/2003
		US 2003-0232554 A1	18/12/2003
		US 2004-0001002 A1	01/01/2004
		US 2004-0019993 A1	05/02/2004
		US 2004-0021617 A1	05/02/2004
		US 2004-0119602 A1	24/06/2004
		US 2004-0139570 A1	22/07/2004
		US 2004-0148725 A1	05/08/2004
		US 2004-0217876 A1	04/11/2004
		US 2004-0217877 A1	04/11/2004
		US 2004-0221411 A1	11/11/2004
		US 2005-0134474 A1	23/06/2005
		US 2006-0044149 A1	02/03/2006
		US 2006-0049955 A1	09/03/2006
		US 2006-0152483 A1	13/07/2006
		US 2006-0192683 A1	31/08/2006
		US 2007-0222633 A1	27/09/2007
		US 2008-0048880 A1	28/02/2008
		US 2008-0055105 A1	06/03/2008
		US 2008-0230497 A1	25/09/2008
		US 2008-0278408 A1	13/11/2008
		US 6219876 B1	24/04/2001
		US 6233776 B1	22/05/2001
		US 6417778 B2	09/07/2002
		US 6507285 B2	14/01/2003
		US 6844058 B2	18/01/2005
		US 6873266 B2	29/03/2005

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2014/037970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 6886209 B2	03/05/2005
		US 6917301 B2	12/07/2005
		US 6940418 B2	06/09/2005
		US 6982649 B2	03/01/2006
		US 7009523 B2	07/03/2006
		US 7109881 B2	19/09/2006
		US 7145469 B2	05/12/2006
		US 7205903 B2	17/04/2007
		US 7358861 B2	15/04/2008
		US 7456755 B2	25/11/2008
		US 7511630 B2	31/03/2009
		US 7629896 B2	08/12/2009
		WO 00-65980 A1	09/11/2000
		WO 01-80707 A1	01/11/2001
		WO 02-017768 A3	06/09/2002
		WO 02-038029 A3	12/09/2002
		WO 02-091901 A1	21/11/2002
		WO 02-17768 A2	07/03/2002
		WO 02-38029 A2	16/05/2002
		WO 03-075238 A1	12/09/2003
		WO 03-098345 A1	27/11/2003
		WO 2004-036292 A2	29/04/2004
		WO 2004-036292 A3	17/06/2004
		WO 2004-045362 A2	03/06/2004
		WO 2004-045362 A3	18/11/2004
		WO 2004-045902 A1	03/06/2004
		WO 2004-068452 A2	12/08/2004
		WO 2004-068452 A3	14/10/2004
		WO 2004-086338 A2	07/10/2004
		WO 2004-086338 A3	03/03/2005
		WO 2006-020637 A1	23/02/2006
		WO 2006-034483 A1	30/03/2006
		WO 2008-128245 A1	23/10/2008
		WO 2008-130804 A1	30/10/2008
		WO 2009-058593 A1	07/05/2009