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- (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, 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, IS, JP, KE, KG, KM, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, 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.
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(54) Title: LOW GWP HEAT TRANSFER COMPOSITIONS

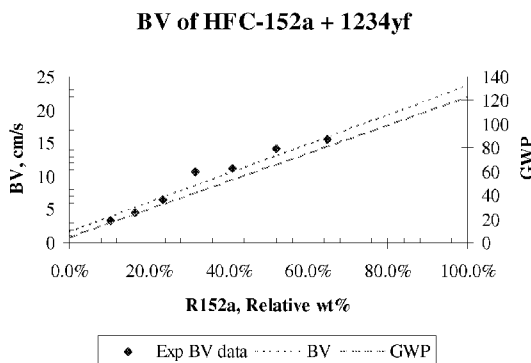


FIG. 1

(57) Abstract: Heat transfer compositions and methods wherein the compositions have a burning velocity (BV) of less than about 10 and a global warming potential (GWP) of less than about 400 comprising: (a) from about 0 to about 50% by weight of HFC-32; (b) from about 50% to about 90% by weight of a compound selected from unsaturated -CF₃ terminated propenes, unsaturated -CF₃ terminated butenes, and combinations of these; and (c) from about 0 to about 25% by weight of a compound selected from HFO-1243zf, HFC-152a, and combinations of these, provided that the combination of components (a) and (c) together comprise at least about 10% by weight of the composition, and further provided that the amount of each of the components (a), (b) and (c) is selected to ensure that the BV of the composition is less than about 10 and the GWP of the composition is less than about 400.



A. CLASSIFICATION OF SUBJECT MATTER*C09K 5/04(2006.01)i, C09K 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)

C09K; F25B; C08J

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: heat transfer, global warming potential(GWP), burning velocity, HFC-32, HFO-1234yf, HFO-1234ze, HFO-1243zf, HFC-152a.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0122545 A1 (MINOR, BARBARA HAVILAND et al.) 20 May 2010 See abstract; paragraphs [0044] and [0226]; Example 3; Tables 9 and 10.	1,2,4,5,7,8,10
Y	See Tables 9 and 10.	1-3,7,8,10
A	See the whole document.	6
X	WO 2010-119265 A1 (MEXICHEM AMANCO HOLDING S.A. DE C.V.) 21 October 2010 See abstract; Tables 3 - 5.	4-6
Y	See abstract; Tables 3 - 5.	1-3,7,8,10
X	WO 2010-064005 A1 (INEOS FLUOR HOLDINGS LIMITED) 10 June 2010 See abstract; Tables 4 and 5.	4-6
Y	See abstract; Tables 4 and 5.	1-3,10
A	See the whole document.	7,8
A	CHATA, F. B. GOROZABEL et al. "Analysis of a direct expansion solar assisted heat pump using different refrigerants", Energy Conversion and Management 25 February 2005, Vol. 46, No. 15-16, Pages 2614-2624. See abstract; Figure 3; Pages 2618-2619.	1-8,10

 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 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

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INTERNATIONAL SEARCH REPORT

International application No.

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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.
A	TAKIZAWA, KENJI et al. "Flammability assessment of CH ₂ =CFCF ₃ : Comparison with fluoroalkenes and fluoroalkanes", Journal of Hazardous Materials 08 August 2009, Vol. 172, No. 2-3, Pages 1329-1338. See Table 2.	1-8, 10
A	WO 2009-047542 A1 (INEOS FLUOR HOLDINGS LIMITED) 16 April 2009 See the whole document.	1-8, 10

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 9
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claim 9 is dependent on claim 13, but claim 13 is missing.

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: Claims 1 - 3 of the present invention are directed to a heat transfer composition having a burning velocity (hereinafter BV) of less than about 10 cm/s, a global warming potential (hereinafter GWP) of less than about 300 and capacity in low temperature refrigerator systems that is within about 10% of the cooling capacity of R-404A, said composition comprising (a) from about 0 to about 50% by weight of HFC-32; (b) from about 50 to about 90% by weight of a compound selected from the group consisting of unsaturated -CF₃ terminated propenes, unsaturated -CF₃ terminated butenes and combinations of these componet; and (c) from about 0 to about 25% by weight of a compound selected from the group consisting of HFO-1243zf, HFC-152a and combinations of these, provided that the combination of components (a) and (c) together comprises at least about 10% by weight of the composition.

(Continued on Extra Sheet)

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/060308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0122545 A1	20.05.2010	AU 2009-316668 A1	27.05.2010
		CA 2741871 A1	27.05.2011
		CN 102215917 A	12.10.2011
		KR 10-2011-0095896 A	25.08.2011
		WO 2010-059677 A2	27.05.2010
		WO 2010-059677 A3	15.07.2010
WO 2010-119265 A1	21.10.2010	AU 2009-323863 A1	10.06.2010
		AU 2009-323865 A1	10.06.2010
		AU 2009-323869 A1	10.06.2010
		AU 2010-238362 A1	21.10.2010
		CA 2745518 A1	10.06.2010
		CA 2745520 A1	10.06.2010
		CA 2745531 A1	10.06.2010
		CN 102239228 A	09.11.2011
		CN 102245731 A	16.11.2011
		CN 102250586 A	23.11.2011
		EP 2367895 A1	28.09.2011
		EP 2367896 A1	28.09.2011
		EP 2367898 A1	28.09.2011
		GB 0906547 D0	20.05.2009
		GB 2457345 A	19.08.2009
		GB 2477835 A	17.08.2011
		GB 2480513 A	23.11.2011
		GB 2480517 A	23.11.2011
		JP 2011-168771 A	01.09.2011
		KR 10-2011-0095131 A	24.08.2011
		KR 10-2011-0099253 A	07.09.2011
		KR 10-2011-0099701 A	08.09.2011
		KR 10-2011-0099702 A	08.09.2011
		KR 10-2011-0128124 A	28.11.2011
		KR 10-2012-0025472 A	15.03.2012
		US 2009-0158771 A1	25.06.2009
		US 2011-0162410 A1	07.07.2011
		US 2011-0173997 A1	21.07.2011
		US 2011-0184890 A1	28.07.2011
		US 2011-0191268 A1	04.08.2011
		US 2011-0258146 A1	20.10.2011
		US 2011-0258147 A1	20.10.2011
		US 2011-0260095 A1	27.10.2011
US 7914696 B2	29.03.2011		
WO 2009-047535 A2	16.04.2009		
WO 2009-047542 A1	16.04.2009		
WO 2010-064005 A1	10.06.2010		
WO 2010-064007 A1	10.06.2010		
WO 2010-064011 A1	10.06.2010		
WO 2011-101608 A1	25.08.2011		
WO 2011-144885 A1	24.11.2011		
WO 2011-144905 A2	24.11.2011		

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/060308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2011-144906 A2	24. 11. 2011
		WO 2011-144906 A3	01. 03. 2012
		WO 2011-144907 A2	24. 11. 2011
		WO 2011-144908 A2	24. 11. 2011
		WO 2011-144908 A3	01. 03. 2012
		WO 2011-144909 A2	24. 11. 2011
		WO 2011-144909 A3	01. 03. 2012
WO 2010-064005 A1	10.06.2010	AU 2009-323863 A1	10.06.2010
		AU 2009-323865 A1	10.06.2010
		AU 2009-323869 A1	10.06.2010
		AU 2010-238362 A1	21. 10. 2010
		CA 2745518 A1	10.06.2010
		CA 2745520 A1	10.06.2010
		CA 2745531 A1	10.06.2010
		CN 102239228 A	09. 11. 2011
		CN 102245731 A	16. 11. 2011
		CN 102250586 A	23. 11. 2011
		EP 2367895 A1	28.09.2011
		EP 2367896 A1	28.09.2011
		EP 2367898 A1	28.09.2011
		GB 2457345 A	19.08.2009
		GB 2477835 A	17.08.2011
		GB 2480513 A	23. 11. 2011
		GB 2480517 A	23. 11. 2011
		JP 2011-168771 A	01.09.2011
		KR 10-2011-0095131 A	24.08.2011
		KR 10-2011-0099253 A	07.09.2011
		KR 10-2011-0099701 A	08.09.2011
		KR 10-2011-0099702 A	08.09.2011
		KR 10-2011-0128124 A	28. 11. 2011
		KR 10-2012-0025472 A	15.03.2012
		US 2009-0158771 A1	25.06.2009
		US 2011-0162410 A1	07.07.2011
		US 2011-0173997 A1	21.07.2011
		US 2011-0184890 A1	28.07.2011
		US 2011-0191268 A1	04.08.2011
		US 2011-0258146 A1	20. 10. 2011
		US 2011-0258147 A1	20. 10. 2011
		US 2011-0260095 A1	27. 10. 2011
		US 7914696 B2	29.03.2011
		WO 2009-047535 A2	16.04.2009
		WO 2009-047542 A1	16.04.2009
		WO 2010-064007 A1	10.06.2010
		WO 2010-064011 A1	10.06.2010
		WO 2010-119265 A1	21. 10. 2010
		WO 2011-101608 A1	25.08.2011
		WO 2011-144885 A1	24. 11. 2011
		WO 2011-144905 A2	24. 11. 2011
		WO 2011-144906 A2	24. 11. 2011

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/060308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2011-144906 A3	01.03.2012
		WO 2011-144907 A2	24.11.2011
		WO 2011-144908 A2	24.11.2011
		WO 2011-144908 A3	01.03.2012
		WO 2011-144909 A2	24.11.2011
		WO 2011-144909 A3	01.03.2012
WO 2009-047542 A1	16.04.2009	AU 2009-323865 A1	10.06.2010
		AU 2009-323869 A1	10.06.2010
		AU 2010-238362 A1	21.10.2010
		CA 2745518 A1	10.06.2010
		CA 2745520 A1	10.06.2010
		CA 2745531 A1	10.06.2010
		CN 102239228 A	09.11.2011
		CN 102245731 A	16.11.2011
		CN 102250586 A	23.11.2011
		EP 2367895 A1	28.09.2011
		EP 2367896 A1	28.09.2011
		EP 2367898 A1	28.09.2011
		GB 0818721 D0	19.11.2008
		GB 2457345 A	19.08.2009
		GB 2477835 A	17.08.2011
		GB 2480513 A	23.11.2011
		GB 2480517 A	23.11.2011
		JP 2011-168771 A	01.09.2011
		KR 10-2011-0095131 A	24.08.2011
		KR 10-2011-0099253 A	07.09.2011
		KR 10-2011-0099701 A	08.09.2011
		KR 10-2011-0099702 A	08.09.2011
		KR 10-2011-0128124 A	28.11.2011
		KR 10-2012-0025472 A	15.03.2012
		US 2009-0158771 A1	25.06.2009
		US 2011-0162410 A1	07.07.2011
		US 2011-0173997 A1	21.07.2011
		US 2011-0184890 A1	28.07.2011
		US 2011-0191268 A1	04.08.2011
		US 2011-0258146 A1	20.10.2011
		US 2011-0258147 A1	20.10.2011
		US 2011-0260095 A1	27.10.2011
		US 7914696 B2	29.03.2011
		WO 2009-047535 A2	16.04.2009
		WO 2009-047542 A1	16.04.2009
		WO 2010-064005 A1	10.06.2010
		WO 2010-064007 A1	10.06.2010
		WO 2010-064011 A1	10.06.2010
		WO 2010-119265 A1	21.10.2010
		WO 2011-101608 A1	25.08.2011
		WO 2011-144885 A1	24.11.2011
		WO 2011-144905 A2	24.11.2011
		WO 2011-144906 A2	24.11.2011

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/060308

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2011-144906 A3	01.03.2012
		WO 2011-144907 A2	24.11.2011
		WO 2011-144908 A2	24.11.2011
		WO 2011-144908 A3	01.03.2012
		WO 2011-144909 A2	24.11.2011
		WO 2011-144909 A3	01.03.2012

Continuation of Box No. III:

Group II: Claims 4 - 6 of the present invention are directed to a heat transfer composition comprising (a) from about 0 to about 50% by weight of HFC-32; (b) from about 50 to about 90% by weight of a compound selected from the group consisting of unsaturated -CF₃ terminated propenes, unsaturated -CF₃ terminated butenes and combinations of these components; and (c) from about 0 to about 25% by weight of a compound selected from the group consisting of HFO-1243zf, HFC-152a and combinations of these, wherein the BV of the composition is less than about 10 cm/s and substantially linearly related to the weight averaged BV of the components.

Group III: Claims 7 and 8 of the present invention are directed to a heat transfer composition having a BV of less than about 10 cm/s, a GWP of less than about 300 and capacity in low temperature refrigerator systems that is within about 10% of the cooling capacity of R-404A, said composition comprising (a) from about 10 to about 50% by weight of HFC-32; and (b) from about 50 to about 90% by weight of a compound selected from the group consisting of unsaturated -CF₃ terminated propenes.

Group IV: Claim 10 of the present invention is directed to a heat transfer composition having a BV of less than about 10 cm/s, a GWP of less than about 300 and capacity in low temperature refrigerator systems that is within about 10% of the cooling capacity of R-404A, said composition comprising (a) from about 10 to about 50% by weight of HFC-32; (b) from about 50 to about 90% by weight of a compound selected from the group consisting of HFO-1234ze, HFO-1234yf and combinations of these; and (c) from about 0 to about 25% by weight of HFC-152a.

The only common technical feature among Group I - IV is: A heat transfer composition having a BV of less than about 10 cm/s, comprising from about 50 to about 90% by weight of a compound selected from the group consisting of unsaturated -CF₃ terminated propenes, unsaturated -CF₃ terminated butenes and combinations of these components.

However, this feature lacks novelty and/or inventive step with respect to the following documents cited in this ISR:

(a) US 2010/0122545 A1, (b) WO 2010/064005 A1, and (c) WO 2010/119265 A1

Thus there is no technical relationship left over the prior art among the claimed inventions, leaving the invention groups without a single general inventive concept.

Hence there is lack of unity "a posteriori"(PCT Rules 13.1 and 13.2).