

hydrofluorocarbons include 1,1,1,2,3,4,4,5,5,5-decafluoropentane and 1,1,1,3,3-pentafluorobutane.

Many aspects and embodiments have been described above and are merely exemplary and not limiting. After reading this specification,
5 skilled artisans appreciate that other aspects and embodiments are possible without departing from the scope of the invention. Other features and benefits of any one or more of the embodiments herein described will be apparent from the following examples, and from the claims.

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EXAMPLES

The concepts described herein will be further described in the following examples, which do not limit the scope of the invention described in the claims.

15 Example 1

Example 1 demonstrates an essentially constant boiling mixture of HFC-43-10mee, ~~HFC-447HFCP~~ and trans-1,2-dichloroethylene.

A solution of 33% HFC-43-10, 8 % ~~HFC-447HFCP~~ and 59 % trans-1,2-dichloroethylene was prepared and mixed thoroughly. The solution was
20 placed in a dual bulb apparatus as shown in Figure 1. One flask (the boil sump) was operated at the boiling point of the solution. The vapor condensed into the second flask (the rinse sump), which then flowed by gravity back into the first flask. The temperature of the boil sump and the composition of the rinse sump were measured over a course of 470
25 minutes. Results obtained are summarized in Table 1.

TABLE 1

Sample (time)	Temp of boil sump (° C)	% HFCM3-10mee	% HFC- ~~e447~~ HFCP	% trans DCE
1	47.6	43.0	5.4	51.6
2	47.0	40.4	6.1	53.5
3	47,2	39.7	6.3	54.0
4	46.7	39.3	6.5	54.2

Results show the boiling point and composition do not change significantly over time and therefore can be considered azeotrope-like.

5 Example 2

A solution of 15% HFC-43-10, 15 ~~HFC-e447~~HFCP, 68 % trans, 1,2-dichloroethylene and 2 % Isopropyl alcohol was prepared and mixed thoroughly. The solution was placed in a dual bulb apparatus as shown in Figure 1. One flask (the boil sump) was operated at the boiling point of the solution. The vapor condensed into the second flask (the rinse sump), which then flowed by gravity back into the first flask. The temperature of the boil sump and the composition of the rinse sump were measured over a course of 435 minutes. Results obtained are summarized in Table 2.

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TABLE 2

Sample (time)	Temp of boil sump (°C)	% HFC-43-1 Omee	% HFC- ~~e447~~ HFCP	% trans DCE	% IPA
1	46.3	19.0	13.0	67.3	0.7
2	46,8	18.7	12.9	67,4	1.0
3	46.8	18.4	13.0	67.3	1.2

Results show the boiling point and composition does not change significantly over time and therefore can be considered azeotrope-like.

20 Example 3

A solution of 4.5 % HFC-43-10, 5.0 % ~~HFC-e447~~HFCP, 87.5 % trans 1,2-dichloroethylene and 3.0 % methanol was prepared and mixed thoroughly.

The solution was placed in a dual bulb apparatus as shown in Figure 1. One flask (the boil sump) was operated at the boiling point of the solution. The vapor condensed into the second flask (the distillate sump), which then flowed by gravity back into the first flask. The temperature of the boil sump and the composition of the distillate sump were measured over a course of 390 minutes. Results obtained are summarized in Table 3.

TABLE 3

Sample (time)	Temp of boil sump (°C)	% HFC-43-10mee	% ~~HFC-6447~~ <u>HFCP</u>	% trans DCE	% methanol
1 (60 min)	47.4	6.2	5.1	84.8	3.9
2(270 min)	46.5	5.7	5.2	85.6	3.5
3(390 min)	46.5	5.8	5.2	85.2	3.8

Example 4

A solution of 6.2 % HFC-43-10, 6.1 % ~~HFC-6447~~ HFCP, 87.7 % trans 1,2-dichloroethylene was prepared and mixed thoroughly. The solution was placed in a dual bulb apparatus as shown in Figure 1. The boil flask was operated at the boiling point of the solution. The vapor condensed into the second flask (the distillate flask), which then flowed by gravity back into the first flask. The temperature of the boil flask and the composition of the distillate flask were measured over a course of 480 minutes. Results obtained are summarized in Table 4.

TABLE 4

Sample (time)	Temp of boil sump (° C)	% HFC-43-10mee	% ~~HFC-6447~~ <u>HFCP</u>	% trans DCE
1 (120 min)	47.7	9.9	6.9	83.2
2 (240 min)	47.5	8.9	6.8	84.3
3 (360 min)	48.2	8.9	6.7	84.4
4 (480 min)	48.2	8.3	6.6	85.1

Example 5

A solution of 14.7 % HFC-43-10, 15.0 % ~~HFC-447~~ HFCP and 70.3 % trans 1,2-dichloroethylene was prepared and mixed thoroughly. The solution was placed in a dual bulb apparatus as shown in Figure 1. The boil flask was operated at the boiling point of the solution. The vapor condensed into the second flask (the distillate flask), which then flowed by gravity back into the first flask. The temperature of the boil flask and the composition of the distillate flask were measured over a course of 465 minutes. Results obtained are summarized in Table 5.

TABLE 5

Sample (time)	Temp of boil sump (° C)	% HFC-43-10mee	% ~~HFC-447~~ <u>HFCP</u>	% trans DCE
1 (105 min)	46.3	18.9	12.9	68.2
2 (225 min)	47.1	19.6	12.5	67.9
3 (345 min)	46.9	19.2	12.8	68.0
4 (465 min)	46.6	18.1	13.2	68.7

Example 6

A solution of 42.7 % HFC-365, 8.3 % ~~HFC-447~~ HFCP and 49.0 % trans 1,2-dichloroethylene was prepared and mixed thoroughly. The solution was placed in a dual bulb apparatus as shown in Figure 1. The boil flask was operated at the boiling point of the solution. The vapor condensed into the second flask (the distillate flask), which then flowed by gravity back into the first flask. The temperature of the boil flask and the composition of the distillate flask were measured over a course of 480 minutes. Results obtained are summarized in Table 6.

TABLE 6

Sample (time)	Temp of boil sump (° C)	% HFC-365mfc	% ~~HFC-6447~~ HFCP	% trans DCE
1	39.6	50.1	3.7	46.2
2	40.0	49.2	3.9	46.9
3	40.0	48.7	4.1	47.2
4	40.0	48.6	4.2	47.2

Example 7

A solution of 10.3 % HFC-365, 19.7 % ~~HFC-6447~~HFCP and 70.0 % trans 1,2-dichloroethyene was prepared and mixed thoroughly. The solution was placed in a dual bulb apparatus as shown in Figure 1. The boil flask was operated at the boiling point of the solution. The vapor condensed into the second flask (the distillate flask), which then flowed by gravity back into the first flask. The temperature of the boil flask and the composition of the distillate flask were measured over a course of 460 minutes. Results obtained are summarized in Table 7.

TABLE 7

Sample (time)	Temp of boil sump (° C)	% HFC-365mfc	% ~~HFC-6447~~ HFCP	% trans DCE
1 (100 min)	46.7	12.2	18.2	69.6
2 (220 min)	46.9	13.4	16.9	69.7
3 (340 min)	47.0	12.6	17.6	69.8
4 (460 min)	46.9	12.1	17.9	70.0

Example 8

Example 8 demonstrates the solubility of hydraulic fluid in mixtures as a function of composition.

The solubility of ML 5606 hydraulic fluid was determined in various mixtures of HFC-43-10mee, HFCP and trans-1,2-dichloroethylene by preparing saturated solutions of hydraulic fluid in the various solvent

Example 10

Freezing points were determined by mixtures of HFC-43-10mee and ~~HFC-447~~ HFCP. Blends were prepared by weighing appropriate amounts of the two hydrofluorocarbons into sample bottles and then shaking to mix thoroughly. The samples were then placed in a storage chamber maintained at 0° C for 24 hours, and then observed. Observations are recorded in Table 10.

TABLE 10

Wt%HFC-43-10mee	Wt % ~~HFC-447~~ <u>HFCP</u>	Appearance
2	98	Frozen solid
5	95	Frozen solid
8	92	Frozen solid
10	90	Liquid with 10% solid
15	85	Clear liquid

Example 11

Freezing points were determined by mixtures of HFC-365mfc and ~~HFC-447~~ HFCP. Blends were prepared by weighing appropriate amounts of the two hydrofluorocarbons into sample bottles and then shaking to mix thoroughly. The samples were then placed in a storage chamber maintained at 0° C for 24 hours, and then observed. Observations are recorded in Table 11.

TABLE 11

Wt % HFC365mfc	Wt % ~~HFC-447~~ <u>HFCP</u>	Appearance
0	100	Solid
5	95	Solid w/ 5% liquid
10	90	Liquid w/ 10% solid
15	85	Liquid
20	80	Liquid
25	75	Liquid

CLAIMS

What is claimed is:

- 5 1. An azeotrope-like composition comprising: from ~~about~~ 2% by weight to ~~about~~ 50% by weight of a ~~hydrofluorocarbon comprising~~ 1,1,1 ,3,3-pentafluorobutane, from ~~about~~ 2% by weight to ~~about~~ 50% by weight 1,1 ,2,2,3,3,4-heptafluorocyclopentane, and an amount effective in dissolving oils and contaminants of trans-1 ,2-dichloroethylene.
- 10 2. The composition of claim 1 wherein the composition comprises from ~~about from about~~ 10% by weight to ~~about~~ 50% by weight 1,1, 1 ,3,3-pentafluorobutane, from ~~about~~ 2% by weight to ~~about~~ 50% by weight 1,1,2,2,3,3,4-heptafluorocyclopentane, and at least ~~about~~ 41% by weight trans-1 ,2-dichloroethylene.
- 15 3. The azeotrope-like composition of claim 1 wherein the composition comprises from ~~about from about~~ 10% by weight to ~~about~~ 50% by weight 1,1 ,1 ,3,3-pentafluorobutane, from ~~about~~ 2% by weight to ~~about~~ 20% by weight 1,1,2,2,3,3,4-heptafluorocyclopentane, and from ~~about~~ 46% by weight to ~~about~~ 80% by weight trans-1 ,2-dichloroethylene.
- 20 4. The azeotrope-like composition of claim 1 further comprising from ~~about~~ 1% by weight to ~~about~~ 6% by weight of an alcohol.
5. The azeotrope-like composition of claim 4 wherein the alcohol is selected from the group consisting of methanol, ethanol, 1-propanol, 2-propanol and 2-methyl-2-propanol.
- 25 6. The azeotrope-like composition of claim 5 wherein the alcohol is 2-propanol.