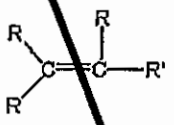
CLAIMS:

1. A method of transferring heat to or from a fluid or body to provide heating or cooling of air in an automobile said method comprising;
(a) providing a heat transfer composition comprising at least one lubricant and at least one fluoroalkene of Formula II:



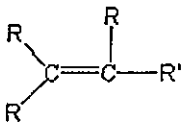
(II)

where
R' is $(CR_2)_nY$,
Y is CF_3
each R is independently Cl, F, I or H
and n is 0 or 1,
provided that at least one of said Rs located on the unsaturated terminal carbon is H, wherein said fluoroalkene has no substantial acute toxicity. .

2. The method or system of any of claims 1, 8, 9 or 19-21, wherein said fluoroalkene has an unsaturated terminal carbon with one F substituent.
3. The method or system of any of claims 1, 8, 9 or 19-21 wherein n is 0.
4. The method or system of any of claims 1, 8, 9 or 19-21 wherein said unsaturated terminal carbon has no F substituent.
5. The method of claim 4 wherein each substituent of the unsaturated terminal carbon is H.
6. The method or system of any of claims 1, 8, 9 or 19-21 wherein n is 1.
7. The method or system of any of claims 1, 8, 9 or 19-21 wherein said

fluoroalkene of Formula II comprises HFO-1234yf .

8. A method of providing heat transfer to or from air using automotive air conditioning systems, said method comprising introducing to such system a composition comprising at least one lubricant and at least one fluoroalkene of Formula II:



(II)

where

R' is $(CR_2)_nY$,

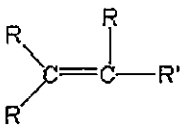
Y is CF_3

each R is independently Cl, F, I or H

and n is 0 or 1,

provided that at least one of said Rs located on the unsaturated terminal carbon is H, wherein said fluoroalkene has no substantial acute toxicity.

9. A method of replacing a heat transfer composition contained in an existing heat transfer system for transferring heat to or from air, said heat transfer system selected from automotive air conditioning system, commercial refrigeration system, chillers and residential refrigerator and freezers, said method comprising withdrawing at least a portion of the existing refrigerant from the system and adding to the system a fluoroalkene of Formula II:



(II)

where

R' is $(CR_2)_nY$,

Y is CF_3

each R is independently Cl, F, I or H

and n is 0 or 1,

provided that at least one of said Rs located on the unsaturated terminal carbon is H, wherein said fluoroalkene has no substantial acute toxicity .

10. The method of claim 9 wherein said existing refrigerant is selected from the group consisting of HFC-134a, R-12 and R-500.

11. The method of any of claims 9 or 10 wherein said existing refrigerant system is an automotive air conditioning system.

12. The method of claim 11 wherein said fluoroalkene of Formula II comprises HFO-1234yf and/or HFO-1234ze.

13. The method of claim 11 wherein said fluoroalkene of Formula II consists essentially of HFO-1234yf or HFO-1234ze.

14. The method of claim 11 wherein said heat transfer composition comprises from about 5 wt% to about 95 wt% of HFO-1234yf.

15. The method of claim 11 wherein said heat transfer composition comprises from about 5 wt% to about 95 wt% of HFO-1234ze.

16. The method of claim 15 wherein said existing refrigerant system is a chiller.

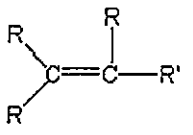
17. The method or system of any of claims 1, 8, 9 or 19-21 wherein said fluoroalkene of Formula II comprises HFO-1234ze.

18. The method or system of any of claims 1, 8, 9 or 19-21 : wherein said fluoroalkene of Formula II comprises transHFO-1234ze.

19. A method for cooling the air in an automobile comprising:

(a) providing in said automobile a vapor compression air conditioning system having at least one compressor and at least one condenser operable in a temperature range that includes about 150°F; and

(b) providing a heat transfer fluid in said system, said heat transfer fluid comprising at least one fluoroalkene of Formula II:



(II)

where

R' is $(CR_2)_nY$,

Y is CF_3

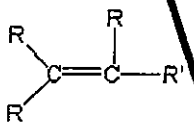
each R is independently Cl, F, I or H

and n is 0 or 1,

provided that at least one of said Rs located on the unsaturated terminal carbon is H.

20. A method of conditioning the air in an automobile using an automobile air conditioning system including at least one compressor and at least one evaporator, said method comprising:

(a) utilizing in said system a heat transfer fluid comprising at least one fluoroalkene of Formula II:



(II)

where

R' is $(CR_2)_nY$,

Y is CF_3

each R is independently Cl, F, I or H

and n is 0 or 1,

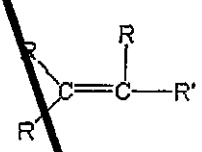
provided that at least one of said Rs located on the unsaturated terminal carbon is H; and

(b) using said heat transfer fluid to absorb heat from the air in the automobile by evaporating in said evaporator said heat transfer fluid to produce a vapor comprising said at least one fluoroalkene;

(c) compressing at least a portion of said vapor from said step (b) in said at least one compressor; and

(d) removing heat from said vapor produced in step (b) by condensing said vapor.

21. A vapor compression system for providing heat transfer comprising a refrigeration system comprising a compressor, a condenser and a heat transfer fluid in said system, said heat transfer fluid comprising at least one fluoroalkene of Formula II:



(II)

where

R' is $(CR_2)_nY$,

Y is CF_3

each R is independently Cl, F, I or H

and n is 0 or 1,

provided that at least one of said Rs located on the unsaturated terminal carbon is H, wherein said system is operable at a condenser temperature which includes 150°F.

22. A heat transfer composition comprising:

(a) a refrigerant comprising at least one fluoroalkene of Formula I:

$$XCF_zR_{3-z} \text{ (I)}$$

where X is a C_2 or a C_3 unsaturated, halogen substituted, alkyl radical and z is 1 to 3, provided that when said compound has an unsaturated terminal carbon, then there is at least one H on said unsaturated terminal carbon; and

(b) a lubricant, provided that said lubricant and said refrigerant have one liquid phase at at least one temperature between about -50°C and +70°C measured at 5% by weight of lubricant based on the weight of the refrigerant and lubricant, and further provided that said heat transfer composition has a Global Warming Potential (GWP) of not greater than about 1000.

23. A method of transferring heat to or from a fluid or body comprising:

(a) providing a heat transfer composition comprising a refrigerant and at least one lubricant, said refrigerant comprising a fluoroalkene of Formula I:

XCF_zR_{3-z} (I)

where X is a C2 or a C3 unsaturated, halogen substituted, alkyl radical and z is 1 to 3, provided: (i) that when said compound has an unsaturated terminal carbon, then there is at least one H on said unsaturated terminal carbon; (ii) that said lubricant and said refrigerant have one liquid phase at at least one temperature between about –50°C and +70°C measured at 5% by weight of lubricant based on the weight of the refrigerant and lubricant; and (3) that said heat transfer composition has a Global Warming Potential (GWP) of not greater than about 1000; and

(b) causing heat to be transferred to and/or from said refrigerant.

24. A vapor compression system for providing heat transfer comprising a refrigeration system comprising a compressor, a condenser and a heat transfer composition in said system, said heat transfer composition comprising a fluoroalkene of Formula I:

XCF_zR_{3-z} (I)

where X is a C2 or a C3 unsaturated, halogen substituted, alkyl radical and z is 1 to 3, provided that when said compound has an unsaturated terminal carbon, then there is at least one H on said unsaturated terminal carbon, wherein said system is operable at a condenser temperature which includes 150°F.

25. The method or system of any of claims 1, 8, or 22-23 wherein said lubricant is selected from the group consisting of polyol esters, poly alkylene glycols, polyalkylene silicon oils, mineral oils, alkyl benzenes, poy(alpha-olefins) and combinations of these.

26. The method or system of any of claims 1, 8, or 22-23 wherein said lubricant comprises at least one polyalkylene glycol.

27. The method or system of any of claims 1, 8, or 22-23 wherein said lubricant comprises at least one polyol ester.

28. The method or system of any of claims 19-21 or 24 wherein said heat transfer composition further comprises a lubricant.

29. The method or system of claim 28 wherein said lubricant is selected from the group consisting of polyol esters, poly alkylene glycols, polyalkylene silicon oils, mineral oils, alkyl benzenes, poy(alpha-olefins) and combinations of these.

30. The method or system of claim 28 wherein said lubricant comprises at least one polyalkylene glycol.

31. The method or system of claim 28 wherein said lubricant comprises at least one polyol ester.

32. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition has a Global Warming Potential (GWP) of not greater than about 500.

33. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition has an ODP of not greater than about 0.05.

34. The method or system of any of claims 1, 8, 9 or 19-24 wherein said fluoroalkene is present in the heat transfer composition in an amount of from about 5 % by weight to about 95 % by weight.

35. The method or system of any of claims 1, 8, 9 or 19-24 wherein said fluoroalkene is present in the heat transfer composition in an amount of from about 5 % by weight to about 95 % by weight.

36. The method or system of any of claims 1, 8, 9 or 19-24 wherein said fluoroalkene is present in the heat transfer composition in an amount of at least about 50 % by weight.

37. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition further comprises one or more of the following: difluoromethane (HFC-32); pentafluoroethane (HFC-125); 1,1,2,2-

tetrafluoroethane (HFC-134); 1,1,1,2-tetrafluoroethane (HFC-134a); difluoroethane (HFC-152a); 1,1,1,2,3,3,3-heptafluoropropane (HFC-227ea); 1,1,1,3,3,3-hexafluoropropane (HFC-236fa); 1,1,1,3,3-pentafluoropropane (HFC-245fa); 1,1,1,3,3-pentafluorobutane (HFC-365mfc); water; and CO_2.

38. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition further comprises a flammability suppressant.

39. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition has one liquid phase over the entire temperature range of from about –50°C and +70°C measured at 5% by weight of lubricant based on the weight of the fluoroalkene and lubricant.

40. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition is stable when in contact with aluminum, steel and copper under the conditions of use in said air conditioning systems.

41. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition comprises from about 5 % by weight to about 95 % by weight of HFO-1234yf.

42. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition comprises from about 5 % by weight to about 95 % by weight of HFO-1234ze.

43. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition comprises from about 5 % by weight to about 95 % by weight of transHFO-1234ze.

44. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition consists essentially of HFO-1234yf.

45. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition consists essentially of HFO-1234ze.

46. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition consists essentially of transHFO-1234ze.

47. The method or system of any of claims 22-24 wherein said heat transfer

comprises transferring heat from air.

48. The method or system of any of claims 22-24 wherein said heat transfer comprises transferring heat from air in an automobile.

49. The method or system of any of claims 22-24 wherein X is a C3 unsaturated, halogen substituted, alkyl radical.

50. The method or system of any of claims 49wherein wherein Z is 3.

51. The method or system of any of claims 22-24 wherein X is a C2 unsaturated, halogen substituted, alkyl radical.

52. The method or system of any of claims 51 wherein wherein Z is 3.

53. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition has a capacity relative to HFC-134a of 1.

54. The method or system of any of claims 1, 8, 9 or 19-24 wherein said heat transfer composition has a Coefficient of Performance (COP) relative to HFC-134a of 1.

55. The method or system of any of claim 54 wherein said heat transfer composition has a capacity relative to HFC-134a of 1.

56. Use as a refrigerant of a composition comprising a tetrafluoropropene (HFO-1234), in an automobile air conditioning system.

57. Use according to claim 56, wherein the composition further comprises a lubricant.

58. Use according to claim 57, wherein the lubricant is present in an amount of from 30 to 50% by weight of the composition.

59. Use according to claim 57 wherein the lubricant comprises a polyalkylene glycol lubricant.

60. Use according to claim 56 wherein the composition comprises 2,3,3,3-tetrafluoropropene (HFO-1234yf).

CLAIMS:

1. A method of transferring heat to or from a fluid or body to provide heating or cooling of air in an automobile said method comprising:

(a) providing a heat transfer composition comprising at least 50% by weight of a refrigerant consisting of HFO-1234yf
and a lubricant consisting of polyalkylene glycol(s)
wherein said heat transfer composition has a capacity relative to HFC-134a of 1 and a Coefficient of Performance (COP) relative to HFC-134a of 1.

2. A method of providing a heat transfer to or from air using automotive air conditioning systems, said method comprising introducing to such system a heat transfer composition comprising at least 50% by weight of a refrigerant consisting of HFO-1234yf and a lubricant consisting of polyalkylene glycol(s)
wherein said heat transfer composition has a capacity relative to HFC-134a of 1 and a Coefficient of Performance (COP) relative to HFC-134a of 1.

3. A method of transferring heat from air in an automobile comprising:

(a) providing a heat transfer composition comprising at least 50% by weight of a refrigerant consisting of HFO-1234yf
and a lubricant consisting of polyalkylene glycol(s)

wherein said lubricant and said refrigerant have one liquid phase at at least one temperature between about -50°C and +70°C measured at 5% by weight of said lubricant based on the weight of the refrigerant and lubricant;

wherein said heat transfer composition has a Global Warming Potential (GWP) of not greater than 1000; and

wherein said heat transfer composition has a capacity relative to HFC-134a of 1 and a Coefficient of Performance (COP) relative to HFC-134a of 1; and

(b) causing heat to be transferred to and/or from said heat transfer composition.

4. The method of any of claims 1 to 3 wherein said heat transfer composition has a Global Warming Potential (GWP) of not greater than 500.

5. The method of any of claims 1 to 4 wherein said heat transfer composition has an ODP of not greater than 0.05.

6. The method of any of claims 1 to 5 wherein said heat transfer composition further comprises one or more of the following:

difluoromethane (HFC-32); pentafluoroethane (HFC-125), 1,1,2,2-tetrafluoroethane (HFC-134); 1,1,1,2-tetrafluoroethane (HFC-134a); difluoroethane (HFC-152a); 1,1,1,2,3,3,3-heptafluoropropane (HFC-227ea); 1,1,1,3,3,3-hexafluoropropane (HFC-236fa); 1,1,1,3,3-pentafluoropropane (HFC-245fa); 1,1,1,3,3-pentafluorobutane (HFC-365mfc); water and CO_2.

7. The method of any of claims 1 to 6 wherein said heat transfer composition further comprises a flammability suppressant.

8. The method of any of claims 1 to 7 wherein said heat transfer composition has one liquid phase over the entire temperature range of from -50°C and +70°C measured at 5% by weight of the lubricant based on the weight of the fluoroalkene and lubricant.

9 The method of any of claims 1 to 8 wherein said heat transfer composition is stable when in contact with aluminium, steel and/or copper under the conditions of use in said air conditioning systems.

10. The method of any preceding claim, wherein said lubricant is present in the heat transfer composition in an amount of from 30% to 50% by weight.

11. The method of any preceding claim wherein said HFO-1234yf is present in the heat transfer composition in an amount of at least 70% by weight.

12. The method of any preceding claim wherein said refrigerant has no substantial acute toxicity as measured by inhalation exposure to mice and rats.

13. The method of any preceding claim wherein said refrigerant has a Global Warming Potential (GWP) of not greater than 150.