their widespread use may also be limited in the future. Thus, there is a need for compositions that do not contribute to the destruction of stratospheric ozone and also have low global warming potentials (GWPs). Certain hydrofluoroolefins, such as 1,1,1,4,4,4-hexafluoro-2-butene ($CF_3CH=CHCF_3$, FC-1336mzz), are believed to meet both goals.

SUMMARY OF THE INVENTION

This application includes eight different types of azeotropic or azeotrope-like mixtures.

In one aspect, there is provided an azeotrope composition consisting essentially of about 37.1 mole percent to about 48.6 mole percent Z-1,1,1,4,4,4-hexafluoro-2-butene and from about 62.9 mole percent to about 51.4 mole percent 2-methylbutane, which has boiling point temperature of from about −20° C. to about 120° C. at a pressure of from about 2.7 psia to about 199 psia.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) methyl formate; wherein the methyl formate is present in an effective amount to form an azeotropic or azeotrope-like mixture with Z-FC-1336mzz.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) pentane; wherein the pentane is present in an effective amount to form an azeotropic or azeotrope-like mixture with Z-FC-1336mzz.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) 2-methylbutane (isopentane); wherein the isopentane is present in an effective amount to form an azeotropic or azeotrope-like mixture with Z-FC-1336mzz.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) 1,1,1,3,3-pentafluorobutane ($CF_3CH_2CF_2CH_3$, HFC-365mfc); wherein the HFC-365mfc is present in an effective amount to form an azeotrope-like mixture with Z-FC-1336mzz.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) trans-1,2-dichloroethylene; wherein the trans-1,2-dichloroethylene is present in an effective amount to form an azeotropic or azeotrope-like mixture with Z-FC-1336mzz.

This disclosure also provides a composition consisting essentially of (a) Z-FC-1336mzz and (b) 1,1,1,3,3-pentafluoropropane ($CF_3CH_2CF_2H$,

CLAIMS

1. A composition consisting essentially of:

(a) Z-1,1,1,4,4,4-hexafluoro-2-butene; and

(b) 2-methylbutane; wherein the 2-methylbutane is present in an effective amount to form an azeotropic combination with the Z-1,1,1,4,4,4-hexafluoro-2-butene.

2. The azeotropic composition of claim 1 consisting essentially of from about 37.1 mole percent to about 48.6 mole percent Z-1,1,1,4,4,4-hexafluoro-2-butene and from about 62.9 mole percent to about 51.4 mole percent 2-methylbutane, which has boiling point temperature of from about -20 °C to about 120 °C at a pressure of from about 2.7 psia (19 kPa) to about 199 psia (1370 kPa).

3. A composition consisting essentially of:

(a) Z-1,1,1,4,4,4-hexafluoro-2-butene; and

(b) 2-methylbutane; wherein the 2-methylbutane is present in an effective amount to form an azeotrope-like combination with the Z-1,1,1,4,4,4-hexafluoro-2-butene.

4. The azeotrope-like composition of claim 3 consisting essentially of from 1 to 99 weight percent Z-1,1,1,4,4,4-hexafluoro-2-butene and from 99 to 1 weight percent 2-methylbutane, characterized by: at a temperature of from -40 °C to 120 °C, said composition having a difference in dew point pressure and bubble point pressure of less than or equal to 5 percent based upon the bubble point pressure.

5. A process for preparing a thermoplastic or thermoset foam comprising using an azeotropic or azeotrope-like composition as a blowing agent, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.

6. A process for producing refrigeration comprising condensing an azeotropic or azeotrope-like composition and thereafter evaporating said azeotropic or azeotrope-like composition in the vicinity of the body to be

cooled, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.

7. A process comprising using an azeotropic or azeotrope-like composition as a solvent, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.
8. A process for producing an aerosol product comprising using an azeotropic or azeotrope-like composition as a propellant, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.
9. A process comprising using an azeotropic or azeotrope-like composition as a heat transfer media, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.
10. A process for extinguishing or suppressing a fire comprising using an azeotropic or azeotrope-like composition as a fire extinguishing or suppression agent, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.
11. A process comprising using an azeotropic or azeotrope-like composition as dielectrics, wherein said azeotropic or azeotrope-like composition consists essentially of Z-1,1,1,4,4,4-hexafluoro-2-butene and 2-methylbutane.

CLAIMS

1. An azeotrope composition consisting essentially of about 37.1 mole percent to about 48.6 mole percent Z-1,1,1,4,4,4-hexafluoro-2-butene and from about 62.9 mole percent to about 51.4 mole percent 2-methylbutane, which has boiling point temperature of from about −20° C. to about 120° C. at a pressure of from about 2.7 psia to about 199 psia.