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AZEOTROPIC COMPOSITION OF 1,1,2,2-TETRACHLORO - 1,2-DIFLUOROETHANE AND TRICHLOROETHYLENE

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ABSTRACT OF THE DISCLOSURE

The disclosure relates to azeotropic mixtures of tetrachlorodifluoroethane and trichloroethylene. It has been discovered that this azeotrope may be used in solvent vapor cleaning and degreasing applications.

This invention relates to an azeotropic composition and particularly to the azeotropic mixture of tetrachlorodifluoroethane and trichloroethylene.

Chlorofluoroethane solvents known in the art ordinarily do not have sufficient solvent power to clean "printed circuit boards"; that is, to effectively remove the rosin flux and other contaminants deposited on the surface of such boards during the application of conductive metal leads thereto. Ultrasonic or vapor degreasing techniques may be used to improve the cleaning action of such solvents. Although mixtures of solvents have been used for this purpose they have the disadvantage that they boil over a range of temperatures and consequently undergo fractionation in vapor degreasing or ultrasonic applications which are open to the atmosphere. Additionally, when employing either of these methods the solvent must also be relatively nontoxic and nonflammable for safety reasons.

Tetrachlorodifluoroethane is a relatively high boiling halocarbon and for this reason is especially advantageous in vapor degreasing applications. At these higher temperatures the vapor has more of a tendency to dissolve high melting greases, or fluxes as well as oil residues and the like and at a faster rate. When articles such as circuit boards are passed through a vapor degreaser, the solvent vapors tend to condense on the article until the articles are heated by the vapors from room temperature to the temperature of the vapor. The condensation thus formed on the articles tends to drip back into the solvent reservoir taking with it some of the soil on the article. For this reason the ability of a cleaning solvent to condense on and wet the surface is especially advantageous. Higher boiling solvents prolong this condensation effect in a continuous degreaser since it takes a greater amount of time to bring the article passing through the degreaser up to the vapor temperature of the solvent. Consequently higher boiling solvents generally allow for longer periods of cleaning action per unit of time in a continuous vapor degreaser than the lower boiling solvents.

Tetrachlorodifluoroethane also is a better solvent for most types of materials than trichlorotrifluoroethane however, it suffers the disadvantage that it is solidus at room temperature whereas the latter is liquidus. Accordingly tetrachlorodifluoroethane is more difficult to handle than liquid type cleaning solvents.

It is an object of this invention to provide a constant boiling or azeotropic solvent that is a liquid at room temperature, will not fractionate and also has the foregoing advantages. Another object is to provide an azeotropic composition which is valuable as a solvent for oils and greases particularly for cleaning printed circuits. A further object is to provide an azeotropic composition which

is both relatively nontoxic and noflammable both in the liquid phase and in the vapor phase and which at the same time is an excellent solvent for cleaning printed circuits especially by continuous degreasing or ultrasonic means.

The above object of this invention may be accomplished by novel mixtures comprising a two component composition of tetrachlorodifluoroethane (e.g. 1,1,2,2-tetrachloro-1,2-difluoroethane) as a first component and trichloroethylene as a second component. Although 1,1,2,2-tetrachloro-1,2-difluoroethane is a preferred tetrachlorodifluoroethane component, the isomer 1,1,1,2-tetrachloro-2,2-difluoroethane may be substituted as a component therefore in whole or in part and especially in minor amounts or trace amounts. All of these mixtures form azeotropes which distill at a constant temperature, the liquid phase and the vapor phase in equilibrium therewith having the same composition. Such mixtures are relatively nonflammable and nontoxic in both the liquid phase and the vapor phase. These mixtures are particularly useful as solvents for greases, oils, waxes and the like and are particularly useful for cleaning printed circuits.

Although the azeotropic mixtures are obtained at approximately 760 mm. Hg a variation in pressure and consequently a change in the compositions and boiling points are also intended to be within the broad scope of the invention. Thus the azeotropes may contain many different proportions of the aforementioned components provided a constant boiling mixture is obtained at the various pressures at which the compositions are used. Stated otherwise any pressure may be employed to obtain the azeotropes of this invention as long as a two component constant boiling mixture is obtained, and accordingly the ratio of components of the azeotropes of the invention will also vary. The variation of components is thus within the skill of the art and is easily determined once it is known that the halogenated hydrocarbons of this invention will form the aforementioned azeotropes. In a preferred embodiment the present invention relates to the aforementioned azeotropes that boil at atmospheric pressure ± about 25, especially ± about 15 mm. Hg.

EXAMPLE I

An azeotropic composition is obtained by distilling a mixture of 1,1,2,2-tetrachloro-1,2-difluoroethane and trichloroethylene. The mixture is charged to a laboratory scale distillation flask having an overhead condenser with provision for the removal of the distillate. The mixture is heated to its atmospheric boiling point and distilled at a high reflux. An azeotropic mixture is obtained consisting essentially of the following composition as measured by gas chromatographic analysis, the boiling point of which is measured at substantially 760 millimeter Hg pressure:

Ex.	Component	Composition, percent by weight	Azeotrope boiling point, ° F. ~760 mm. Hg
1	1,1,2,2-tetrachloro-1,2-difluoroethane	29.8	
	Trichloroethylene	70.2	188

Thus one of the azeotropes of this invention consists essentially of about 29.8 percent by weight 1,1,2,2-tetrachloro-1,2-difluoroethane and about 70.2 percent by weight trichloroethylene at about 760 mm. Hg pressure.

A printed circuit board coated with a rosin flux is cleaned in an ultrasonic degreasing apparatus with the azeotropic mixtures of this invention and substantially all of the rosin flux is removed without any observable effect on the board which constitutes the backing of the printed circuit.

The formation of the azeotropes of this invention is unexpected in view of the fact that azeotropes could not

be obtained with the following bnary and ternary systems of tetrachlorodifluoroethane:

TABLE I.—SYSTEMS WHICH DO NOT FORM AZEOTROPES WITH TETRACHLORODIFLUOROETHANE

	1. Binary—Second component
1,1,2,2-tetrachloro-1,2-difluoroethane	Acetone.
Do	Benzene.
Do	Chloroform.
Do	Cyclohexane.
Do	1,1-dichloroethane.
Do	Heptane.
Do	Methylene chloride.
Do	Perchloroethylene.
Do	Toluene.
Do	1,1,1-trichloroethane.
	2. Ternary:
Do	Methanol/water.
Do	Perchloroethylene/methanol.
Do	Perchloroethylene/ethanol.
Do	Perchloroethylene/isopropanol.

Because of the aforementioned variations in pressure, the azeotropes of the present invention will vary in composition from one fixed pressure as compared to a higher or lower pressure and in each instance the mixture at these various fixed pressures will be a constant boiling mixture and the ratios of the components will not vary. Accordingly, the composition of the azeotrope of this invention will comprise about 29.8 parts by weight ± about 10% especially ± about 5% of 1,1,2,2-tetrachloro-1,2-difluoroethane and its equivalents, especially those equivalents noted herein and about 70.2 parts by weight ± about 10% especially ± about 5% trichloroethylene. By giving the ranges of the azeotropic composition in this manner it is intended for example that the 1,1,2,2-tetrachloro-1,2-difluoroethane and its equivalents, especially those equivalents noted herein shall be present in the azeotrope in an amount comprising about 29.8 parts by weight ± about 2.98 parts by weight or from about 32.78 parts by weight to about 26.82 parts by weight and the like for the other ranges and components expressed in such a manner.

Although the invention has been described by reference to some preferred embodiments it is not intended that the broad scope of the novel azeotropic compositions be limited thereby but that certain modifications are intended to be included within the spirit and broad scope of the following claims.

What is claimed is:

1. A composition of matter consisting essentially of an azeotrope which at about 760 millimeters of mercury pressure and at about 188° F. consists essentially of about 29.8 percent by weight 1,1,2,2-tetrachloro-1,2-difluoroethane and about 70.2 percent by weight trichloroethylene.

2. A method for cleaning a surface by contacting said surface with a composition of matter consisting essentially of an azeotrope which at about 760 millimeters of mercury pressure and at about 188° F. consists essentially of about 29.8 percent by weight 1,1,2,2-tetrachloro-1,2-difluoroethane and about 70.2 percent by weight trichloroethylene.

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