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AZEOTROPIC COMPOSITION

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ABSTRACT OF THE DISCLOSURE

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

The present application is a continuation-in-part of U.S. patent application Ser. No. 590,185 filed Oct. 28, 1966 and now abandoned.

This invention relates to an azeotropic composition and particularly to the azeotropic mixture of tetrachlorodifluoroethane, ethanol and water.

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 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 substantially nontoxic and nonflammable for safety reasons.

Tetrachlorodifluoroethane is a relatively high boiling fluorocarbon and for this reason especially advantageous in vapor degreasing applications since at these temperatures the hot vapor has more of a tendency to dissolve high melting greases, or fluxes as well as oil residues and the like. 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 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 have better cleaning power per unit of time in a continuous vapor degreaser than the lower boiling solvents.

Tetrachlorodifluoroethane also is a better solvent than materials such as 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 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 and particularly for cleaning printed circuits. A further object is to provide an azeotropic composition which is both relatively nontoxic and nonflammable 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 vapor degreasing or ultrasonic means.

The above object of this invention may be accomplished by novel mixtures comprising a three component composition of tetrachlorodifluoroethane (e.g. 1,1,2,2-tetrachloro-1,2-difluoroethane) as a first component, ethanol as a second component and water as a third 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 three 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. These azeotropes comprise about 81±5% especially 81±2% tetrachlorodifluoroethane, about 14±5% especially about 14±2% ethanol and about 5±2.5% especially about 5±1% water on a weight basis.

EXAMPLE I

An azeotropic composition is obtained by distilling a mixture of 75 gms. of 1,1,2,2-tetrachloro-1,2-difluoroethane, 25 gms. of ethanol and 5 gms. of water. The mixture is charged to a laboratory scale distillation still ½" I.D. x 42" long which was vacuum jacketed having an overhead water cooled condenser for the removal of the distillate. The mixture is heated to its atmospheric boiling point and distilled at a high reflux for 30 minutes. An azeotropic mixture is obtained which was analyzed for its water content by the Carl Fischer Method and its organic components by gas chromatography. The boiling point of the mixture is measured at substantially

760 millimeter pressure. The results obtained are tabulated in Table I below.

	Component	Composition percent by weight	Azeotrope boiling point, ° C. at 760 mm. Hg
Example 1	1,1,2,2-tetrachloro-1,2-difluoroethane	82.3	----------
	Ethanol	13.6	----------
	Water	4.1	67.8

Thus one of the azeotropes of this invention consists essentially of about 82.3 percent by weight 1,1,2,2-tetrachloro-1,2-difluoroethylene, about 13.6 percent by weight ethanol and about 4.1 percent by weight of water at about 760 mm. Hg pressure.

A printed circuit board coated with a rosin flux is cleaned in a vapor degreasing apparatus with the azeotropic mixtures of this invention and substantially all of the rosin flux is removed without any detrimental 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 binary and ternary systems of tetrachlorodifluoroethane in Table II.

TABLE II

SYSTEMS WHICH DO NOT FORM AZEOTROPES WITH TETRACHLORODIFLUOROETHANE

(1) Binary

1,1,2,2-tetrachloro-1,2-difluoroethane acetone
1,1,2,2-tetrachloro-1,2-difluoroethane benzene
1,1,2,2-tetrachloro-1,2-difluoroethane chloroform
1,1,2,2-tetrachloro-1,2-difluoroethane cyclohexane
1,1,2,2-tetrachloro-1,2-difluoroethane 1,1-dichloroethane
1,1,2,2-tetrachloro-1,2-difluoroethane heptane
1,1,2,2-tetrachloro-1,2-difluoroethane methylene chloride
1,1,2,2-tetrachloro-1,2-difluoroethane perchloroethylene
1,1,2,2-tetrachloro-1,2-difluoroethane toluene
1,1,2,2-tetrachloro-1,2-difluoroethane 1,1,1-trichloroethane

(2) Ternary

1,1,2,2-tetrachloro-1,2-difluoroethane 112/methanol/water
1,1,2,2-tetrachloro-1,2-difluoroethane 112/perchloroethylene/methanol
1,1,2,2-tetrachloro-1,2-difluoroethane 112/perchloroethylene/ethanol
1,1,2,2-tetrachloro-1,2-difluoroethane 112/perchloroethylene/isopropanol

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. The composition of matter consisting essentially of an azeotropic mixture of about 82.3 parts by weight of 1,1,2,2-tetrachloro-1,2-difluoroethane, about 13.6 parts by weight of ethanol and about 4.1 parts by weight of water having a boiling point of 67.8° C. when measured at about 760 millimeters mercury pressure.

2. A method for cleaning a solid surface comprising contacting said surface with the composition of claim **1.**

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