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SOLVENT COMPOSITIONS

Donald Lomas, Runcorn, England, assignor to Imperial Chemical Industries Limited, London, England

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ABSTRACT OF THE DISCLOSURE

A solvent composition suitable for use in the removal of flux from circuit boards which comprises an azeotropic-forming mixture of trichloro-pentafluoropropane with an alkanol containing 1 to 4 carbon atoms in the molecule.

This invention relates to a cleaning composition comprising trichloropentafluoropropane.

According to the invention there is provided a solvent composition which comprises an azeotropic-forming mixture of trichloropentafluoropropane with an alkanol containing 1 to 4 carbon atoms in the molecule.

Preferably, the mixture is one having a boiling point within 0.5° C. of the boiling point of the azetrope, more particularly within 0.2° C. of the boiling point of the azeotrope although mixtures having boiling points within 1° C. and even within 2° C. of the boiling point of azeotrope may be suitable particularly for use where larger variations in the composition are not critical. It is particularly preferred that the composition comprises the azeotropic mixture.

Preferably, the trichloropentafluoropropane is 1,3,3-trichloro-1,1,2,2,3-pentafluoropropane. The azeotropes of this isomer have the compositions and boiling points at 760 mm. Hg shown in the table.

Alkanol	Approximate alkanol content (percent by weight)	Boiling point (° C.)
Methanol	16	53.6
Ethanol	10	62.0
n-Propanol	4	70.0
Isopropanol	12	66.4
n-Butanol	1.5	74.3
t-Butanol	13	68.8

The cleaning compositions of the invention will remove some contaminants which are not removed by trichloropentafluoropropane alone. In processes which use a cleaning fluid, it is usually necessary from time to time to remove contamination from the liquid by distillation. Such distillation will normally be repeated many times during the useful life of the fluid and if the cleaning fluid consists of two different boiling points these distillations will tend to result in a concentration of one of the liquids and a change of the composition in the cleaning bath. Such a change will cause a change in the solvent power of the cleaning fluid and may result in damage to the articles being cleaned or in the production of a dangerously inflammable mixture. However, by use of essentially azeotropic mixtures it is possible to void any risk of such undesirable consequences, since the azeotropic mixture can be distilled without preferential concentration of one of the components.

Compositions according to the invention have the advantage that they provide a range of solvents which have a greater solvent power than trichloropentafluoropropane while still retaining to a great extent the inertness of trichloropentafluoropropane to synthetic organic polymers, plastics, resins, resin laminates, resin-bonded-paper board, bakelite, fibreglass and like materials.

Because of this enhanced solvent power the use of time-consuming, costly and sometimes unacceptable mechanical devices, such as hand-scrubbing or wiping which may cause damage to sensitive articles, may be avoided.

The compositions of the invention may be used in conventional apparatus and employing conventional operating techniques. The solvent may be used without heat if desired, but the cleaning action of the solvent may be assisted by conventional means, for example use of boiling solvent, agitation or adjuvants.

In some applications it is advantageous to use ultrasonic irradiation in combination with the solvents. This is particularly true when removing certain tenacious fluxes from soldered joints, the ultrasonic irradiation helping to remove the solid and insoluble constituents of the flux.

The high stability of the solvent composition of the invention, and particularly of the azeotropes, under operating conditions makes it usually unnecessary to use stabilizers in the solvents. This has the advantage that when the solvent composition evaporates it leaves a perfectly clean surface uncontaminated with higher boiling stabilizers. However, it is possible that stabilizers may be necessary under corrosive conditions for example those in which the solvent comes into contact with oxidizing agents which can attack the components of the composition.

Other solvents or additives may be added to the solvent composition of the invention if it is desired to increase their cleaning or solvent power. Suitable additives include cationic, anionic and non-ionic detergents.

Solvent composition according to our invention and particularly the azeotropes, are useful in a wide range of applications, including removal of soldering fluxes from electrical equipment, in particular from equipment in which the composition is likely to come into contact with materials such as plastics or resins and cleaning of photographic film or magnetic recording tapes.

The invention is illustrated in the following examples in which all percentages are by weight:

EXAMPLES 1–6

Pure 1,3,3-trichloro-1,1,2,2,3-pentafluoropropane was mixed with a quantity of methanol and the mixture distilled through a vacuum-jacketed column at high reflux ratio to obtain a constant boiling mixture.

The constant boiling mixture obtained was redistilled at a higher reflux ratio. The resulting azetrope was then analyzed by gas chromatography.

The precise boiling point of the azetrope was found by distilling it in a differential ebulliometer and measuring the condensation temperature relative to that of pure 1,-3,3-trichloro-1,1,2,2,3-pentafluoropropane using an ebullioscopic Beckman thermometer.

This was repeated replacing the methanol with in turn, ethanol, n-propanol, isopropanol, n-butanol, and t-butanol.

The azeotropes were found to have the compositions and boiling points of 760 mm. Hg, as shown in the following table:

Example number	Alkanol	Approximate amount of— 1,3,3-trichloro-1,1,2,2,3-pentafluoropropane (percent)	Alkanol (percent)	Boiling point (° C.)
1	Methanol	84	16	53.6
2	Ethanol	90	10	62.0
3	n-Propanol	96	4	70.0
4	Isopropanol	88	12	66.4
5	n-Butanol	98.5	1.5	74.3
6	t-Butanol	87	13	68.8

EXAMPLE 7

The azeotropic mixtures of Examples 1, 2, and 4 were tested for their effectiveness in removing various soldering fluxes from resin-bonded printed circuit boards. Sections of board were painted with various commercially-available fluxes, dried under infrared heating for two minutes and then touch-soldered for 5 seconds, with solder maintained at 250° C. The boards were then immersed in boiling solvent for one minute, after which time they were removed and examined for effectiveness of flux removal. For the purposes of comparison the boards were similarly treated and immersed in an azeotropic comprising 94% of 1,1,2-trichloro-1,2,2-trifluoroethane (113) and 6% of methanol.

The results are shown in the table in which: A represents satisfactory removal; B represents fair removal; and C represents unsatisfactory removal.

TABLE

	Flux						
	Alpha			Fry's		Multi-core	Zeva
Solvent	862 GB	711	809	S64	R8	PC 25	C4
Mixture of—							
Example 1	B	B	A	A	C	A	C
Example 2	B	B	A	B	B	B	C
Example 4	B	A	B	A	A	A	B
113 and methanol	B	B	B	B	B	B	B

I claim:

1. A solvent composition which comprises an azeotropic-forming mixture of approximately 88% by weight of 1,1,3-trichloro-1,1,2,2,3 - pentafluoropropane with approximately 12% by weight of isopropanol, in which the mixture has a boiling point within 0.2° C. of the boiling point of the azeotrope.

2. A method of cleaning articles which comprises treating the articles with the solvent composition of claim 1.

3. A method according to claim 2 in which the article is a printed circuit board contaminated with soldering flux.

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WILLIAM E. SCHULZ, Primary Examiner

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