

**OZONE-FRIENDLY CORRECTION FLUID WITH IMPROVED
OVERWRITE CHARACTERISTIC**

The invention relates to correction fluids.

Correction fluids are used for correcting
5 handwritten, typewritten, photocopied, or laser printed
markings on paper. Generally, correction fluids are
applied to a paper surface over an erroneous marking in
liquid form. The fluid subsequently forms a film which
effectively covers erroneous markings on the surface
10 and can receive a correct marking. Making a corrective
marking over the film commonly is known as "writeover".

Correction fluids typically include some
standard ingredients, including an opacifying pigment
(commonly titanium dioxide), a film-forming polymeric
15 material, and a solvent.

The opacifying pigment is dispersed in the
fluid and provides the basic white color which can be
toned with other pigments to provide a correction fluid
closely corresponding to the color of the paper to
20 which the fluid is to be applied. The opacifying
pigment functions to obscure the erroneous marking over
which the correction fluid is applied.

The film-forming polymeric material, also
known as the binder, binds the pigment to the paper and
25 helps to form a flexible but continuous covering that
remains once the solvent has dried.

The solvent is used as the carrier for the

other ingredients in the fluid. Historically, halogenated hydrocarbons have been the solvents of choice for correction fluid compositions. Halogenated hydrocarbon solvents present special advantages primarily because they have evaporation rates which provide correction fluids that dry rapidly and completely. Additionally, they do not interact with typewritten markings to cause unacceptable bleeding. Also, they can effectively dissolve those film-forming polymeric materials which provide durable but flexible films without causing excessive cockling or distortion of paper surfaces. Despite their recognized advantages when used as correction fluid solvents, the use of halogenated hydrocarbon solvents has become a matter of increased concern primarily because of their adverse effect on the environment (stratospheric ozone depletion). Accordingly, providing an "ozone-friendly" correction fluid by eliminating the use of halogenated hydrocarbon solvents has become desirable. By ozone-friendly correction fluid, we mean a correction fluid which either does not contain a material that migrates to the stratosphere or, if it contains such a material, the material does not cause a reduction in the ozone concentrations.

Attempts have been made to replace the halogenated solvents with non-halogenated alternatives. Aqueous-based systems such as those described in U.S. Patent No. 5,332,599 are not effective for a wide variety of ink formulations. Alternatively, non-halogenated hydrocarbon solvents, such as those described in U.S. Patent Nos. 5,199,976 and 5,306,755 cover a wide range of ink types, but suffer from poor overwrite characteristics.

It is a object of the present invention to provide a correction fluid based on a non-halogenated solvent system with improved overwrite characteristics.

Generally, the invention relates to an ozone-

friendly correction fluid that has improved writeover characteristics. The ozone-friendly correction fluids thus have a key benefit (good writeover characteristic) associated with halogenated hydrocarbon solvent-based correction fluids, but also have the environmental benefits associated with ozone-friendly solvent-based correction fluids.

Specifically, the present invention relates to an ozone-friendly correction fluid comprising a non-halogenated hydrocarbon solvent, a polymeric phase and an opacifying phase, wherein the ratio of opacifying phase to polymeric phase is from about 2.2 to about 3.8 preferably from about 2.4 to about 3.6 (based on weight).

Other features and advantages of the invention will be apparent from the description of the preferred embodiment thereof, and from the claims.

As used herein, the term "overwrite characteristic" relates to a correction fluid films ability to accept new written matter in the form of inks, marker pens and typewriter impacts. Without being bound to theory, applicants believe that this characteristic is related to film strength and paper adhesion. When correction fluid films exhibit weak strength and poor paper adhesion the overwrite characteristic is extremely poor. This typically results in gouging and flaking of the correction fluid while new pen markings are made on the film. Accordingly, correction fluids which exhibit good "overwrite characteristic" do not exhibit excessive flaking or chipping during normal writing pressures. The importance of a good overwrite characteristic is very important with ink pen and typewriter overwrite due to the relatively high pressures applied. The importance of good overwrite characteristic with marker pens is typically less important.

According to the present invention, it has

been discovered that by ratioing the opacifying phase with the polymeric phase of a correction fluid based on a non-halogenated hydrocarbon solvent it is possible to obtain dramatically improved overwrite characteristics.

5 As used herein, the term "opacifying phase" refers to the total amount of opacifying agent found in the correction fluid. The opacifying agents suitable for use in the present invention include commercially available rutile titanium dioxide, anatase titanium
10 dioxide, zinc sulfide, zinc oxide, calcium carbonate or blends or mixtures of these materials. Preferably the opacifying agent have an average particle size between about 0.2 and about 0.4 microns and an average oil absorption of about 14 lbs. oil/100 lbs. pigment to
15 about 36 lbs. per 100 lbs. The amount of opacifying agent can vary depending on the degree of coverage desired (lower amounts will provide poorer coverage while higher amounts will provide extremely opaque coverage). From about 32 to about 55% by weight
20 opacifying agent based on the total weight of the composition is generally suitable. Preferably the opacifying agent is selected from the group consisting of rutile titanium dioxide and anatase titanium dioxide at levels of from about 38 to about 52% by weight based
25 on the total weight of composition.

 As used herein, the "polymeric phase" refers to the film forming binder, (i.e. resin) plasticizers, and dispersants. Binders suitable for use in the present invention include Thermoplastic butyl
30 methacrylate (BMA) copolymer (such as Neocryl B 705 or Neocryl B700 polymer manufactured by Zeneca Resins, Wilmington, MA or Rohagum P 675 supplied by Rohm Tech Inc., Malden, MA); vinyl toluene-butadiene copolymer (such as those manufactured by Goodyear Chemicals);
35 isobutyl methacrylate polymer (IBMP) (Acryloid B67, manufactured by Rohm & Haas, Philadelphia, PA); n-butyl methacrylate polymer (such as Elvacite 2044

manufactured by DuPont Chemical, Wilmington, DE); n-butyl methacrylate/isobutyl methacrylate copolymer (such as Elvacite 2046 manufactured by DuPont Chemical) and mixtures thereof. Suitable "plasticizers" include
5 ditridecyl phthalate. Suitable dispersants include dioctyl sodium sulfosuccinate and polymeric fatty ester (Hypermer LPI manufactured by ICI Americas); and mixtures thereof.

As used herein, suitable "non-halogenated
10 hydrocarbon solvents" include any cyclohexane or alkylated cyclohexane and aliphatic hydrocarbons containing 10 or fewer carbon atoms. Preferably the material is methylcyclohexane.

Optionally, correction fluids of the present
15 invention may also include other typical correction fluid ingredients such as tinting colorants, e.g. lamp black, raw umber, yellow oxide, etc. These tinting colorants are counted as opacifying agents in the "opacifying phase" calculation. Also, a small amount
20 of mustard oil (0.1 - 0.2%) is often added as a deterrent.

According to the present invention, an Opacifying Phase to Polymeric Phase ratio in the range of from 2.2 to 3.8 provides excellent overwrite
25 characteristics when compared with conventional non-halogenated hydrocarbon solvent correction fluid systems. Preferably, the opacifying phase to polymeric phase ratio is from 2.4 to 3.6.

Examples

30 Examples 1-5 below illustrate fluids with Opacifying Phase to Polymeric Phase ratios according to the present invention provide good overwrite properties at high wet fluid lay down, e.g., five mils film thickness. Example 6 below shows a ratio outside the
35 claim range. In use, the Example 6 correction fluid shows inferior overwrite properties at high wet fluid lay down.

Example 1

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	41.41
	2. Thermoplastic IBMA Copolymer,	
5	Neocryl B 705 Polymer	10.78
	3. Ditridecyl Phthalate	3.99
	4. Polymeric Fatty Ester,	
	Hypermer LP1 (ICI Americas, Inc.)	2.22
	5. Titanium Dioxide, Tipure R-931	41.39
10	6. Lamp Black	0.07
	7. Mustard Oil	0.12
	8. Fragrance 759292/0602185	
	(Haarmann & Reimer)	<u>0.02</u>
		100.00
15	Opacifying Phase to Polymeric Phase Ratio:	2.44

Example 2

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	42.30
	2. Thermoplastic IBMA Copolymer,	
20	Neocryl B 705 Polymer	9.65
	3. Ditridecyl Phthalate	3.57
	4. Polymeric Fatty Ester,	
	Hypermer LP1 (ICI Americas, Inc.)	1.98
	5. Titanium Dioxide, Tipure R-931	42.29
25	6. Lamp Black	0.07
	7. Mustard Oil	0.12
	8. Fragrance 759292/0602185	
	(Haarmann & Reimer)	<u>0.02</u>
		100.00
30	Opacifying Phase to Polymeric Phase Ratio:	2.78

Example 3

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	40.17
	2. Thermoplastic IBMA Copolymer,	
5	Neocryl B 705 Polymer	9.16
	3. Ditridecyl Phthalate	3.39
	4. Polymeric Fatty Ester,	
	Hypermer LP1 (ICI Americas, Inc.)	1.88
	5. Titanium Dioxide, Tipure R-931	45.19
10	6. Lamp Black	0.08
	7. Mustard Oil	0.11
	8. Fragrance 759292/0602185	
	(Haarmann & Reimer)	<u>0.02</u>
		100.00
15	Pigment to Binder Ratio:	3.13

Example 4

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	39.69
	2. Thermoplastic IBMA Copolymer,	
20	Neocryl B 705 Polymer	8.52
	3. Ditridecyl Phthalate	3.15
	4. Polymeric Fatty Ester,	
	Hypermer LP1 (ICI Americas, Inc.)	1.75
	5. Titanium Dioxide, Tipure R-931	46.68
25	6. Lamp Black	0.08
	7. Mustard Oil	0.11
	8. Fragrance 759292/0602185	
	(Haarmann & Reimer)	<u>0.02</u>
		100.00
30	Opacifying Phase to Polymeric Phase Ratio:	3.48

Example 5

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	46.21
	2. Vinyl Toluene-Butadiene	
5	Copolymer (Goodyear Chemicals)	9.68
	3. Ditridecyl Phthalate	2.64
	4. Polymeric Fatty Ester, Hypermer LP1 (ICI Americas, Inc.)	1.65
	5. Titanium Dioxide, Tipure R-931	39.60
10	6. Lamp Black	0.07
	7. Mustard Oil	0.13
	8. Fragrance 759292/0602185 (Haarmann & Reimer)	<u>0.02</u>
		100.00
15	Opacifying Phase to Polymeric Phase Ratio:	2.83

Example 6

	<u>Ingredients</u>	<u>Wt. %</u>
	1. Methylcyclohexane	48.91
	2. Vinyl Toluene-Butadiene	
20	Copolymer (Goodyear Chemicals)	8.53
	3. Dioctyl Sodium Sulfosuccinate	1.56
	4. Titanium Dioxide, Tipure R-931	40.79
	5. Lamp Black	0.07
	6. Mustard Oil	0.14
25		100.00
	Opacifying Phase to Polymeric Phase Ratio:	4.04

The correction fluids containing the above ingredients were prepared by first dissolving the binder in the solvent system. Next, the dispersant, plasticizer and opacifying agent were added and the mixture was dispersed for 3 hours in a bead mill after lamp black and mustard oil were added to obtain final fluid composition.

Other embodiments are within the claims. For example, in addition to the most preferred ingredients the composition may also include various additives known to those skilled in the art. These additives are
5 incorporated to improve specific properties. These include flattening agents to control film-glow, flow additives and thickeners to control brushing, leveling and settling and pigment extenders to reduce cost.



C L A I M S

1. An ozone-friendly correction fluid comprising: a non-halogenated hydrocarbon solvent; a polymeric phase and a opacifying phase, wherein the ratio of opacifying phase to polymeric phase is from 2.2 to 3.8 based on weight.
2. A correction fluid of claim 1, wherein said solvent is selected from the group consisting of: cyclohexane; an alkylated cyclohexane; an aliphatic hydrocarbon containing 10 or fewer carbon atoms; or mixtures thereof.
3. A correction fluid of claim 2, wherein said opacifying phase consists of a material selected from the group consisting of rutile titanium dioxide, anatase titanium dioxide, zinc sulfide, zinc oxide, calcium carbonate or blends or mixtures of these materials.
4. A correction fluid of claim 3, wherein said polymeric phase is comprised of a resin material selected from the group consisting of thermoplastic butyl methacrylate, vinyl toluene-butadiene copolymer, isobutyl methacrylate polymer, n-butyl methacrylate/isobutyl methacrylate copolymer and mixtures thereof.
5. A correction fluid of claim 4, wherein said polymeric phase further comprises a ditridecyl phthalate plasticizer.
6. A correction fluid of claim 5, wherein said polymer phase further comprises a dispersant selected from the group consisting of dioctyl sodium sulfosuccinate, polymeric fatty ester and mixtures thereof.
7. A correction fluid according to claim 6, wherein the pigment to binder ratio is in the range of from 2.4 to 3.6.