

Coated Substrates

This invention relates to substrates containing information such as script or print.

5 Previously substrates, for example of paper, wood, plastic film, metal or glass, have been coated with epoxy resin. Certain problems however have been encountered when trying to protect substrates containing information, e.g. print, using a coating of epoxy resin. These problems
10 include:-

- (a) the presence of air bubbles in the coating;
- (b) the surface of the substrate becoming discoloured e.g. oily or wet, particularly in the case of paper;
- (c) the coating not being strong e.g. can be
15 scratched;
- (d) the materials (substrates) being coated could become dented, pop-up, or displaced when the coating is applied; and
- (e) the presence of uneven waves within the coating
20 causing distortion when looking at the substrate, rather than one smooth continuous surface.

According to this invention a substrate containing information protected from damage is one comprising a substrate adjacent to which is a layer of adhesive, to which
25 is adhered informative matter comprising print, script, graphic or pictorial matter or other matter containing information and adjacent to the informative matter, a coating layer of transparent epoxy resin.

Also according to this invention a method for protecting
30 a surface of a substrate against damage comprises applying to the substrate, an adhesive layer, applying to the adhesive layer informative matter comprising print, script, graphic or pictorial matter or other matter containing information and applying to the layer of informative matter,
35 a coating layer of transparent epoxy resin.

The substrate can take many different forms but is preferably paper, card, cardboard, plastic film, wood, metal, glass or marble.

For the adhesive layer, various adhesives can be used, and include dextrin, starch based adhesives, polyvinyl acetate, polyvinyl alcohol and polyacrylic resins. They may be transparent. Preferred however are epoxy resin based
 5 adhesives because of their relatively long curing time, good workability and transparency. Generally, epoxy resin based adhesives with viscosity ranging from 9000 cps - 60,000 cps (9-60 Pa.s) at 25°C which are transparent are suitable. They are formed by the reaction of an epoxide of a
 10 polyvalent alcohol or phenol, preferably bisphenol A, with any transparent polyamine or polyamide.

Usually the thickness of the adhesive layer lies between 100 μ m and 1000 μ m, but it can be thinner or thicker than this range.

15 The informative matter can be in the form of a sheet containing the information, e.g. a drawing, photograph, or printed matter, or it can be for example separate letters, symbols etc. which have to be laid out on the adhesive layer covering the substrate. If the matter comprises letters,
 20 symbols etc., their height can if desired be substantial, e.g. up to 5 mm or even more.

The coating layer is a layer of transparent epoxy resin, thereby utilising the advantages of epoxy resins, namely their high gloss, resistance to dilute acids, alkalis and
 25 heat at 70°C. They are derived by the reaction of an epoxide of a polyvalent alcohol or phenol, preferably bisphenol A, with a polyamine or polyamide.

The epoxy resin coating should have a viscosity of less than 1000 cps at 25°C. Suitable epoxides include
 30 bisphenol A type diepoxy compounds consisting of methylepichlorhydrin or epichlorhydrin and bisphenol A; various (methyl)glycidyl ethers of hydroxyl group-containing compounds such as halogenated bis-phenols, for example bisphenol A tetrabromide, resorcin, bisphenol F,
 35 tetrahydroxyphenyl ethane, novolak, polyalcohols, for example, ethylene glycol, polyglycols, for example, polypropylene glycol and glycerin. Their molecular weight is usually between 500 - 10,000 and, preferably, 800 -

4,000. Among all, bis-phenol A type diepoxy compounds consisting of methyl epichlorhydrin or epichlorhydrin and bis-phenol A are preferably employed.

Any transparent polyamine or polyamide may be used to react with the epoxide. Such polyamines or polyamides can be aliphatic, cycloaliphatic or aromatic. It has been found that a polyamine produces a soft effect whereas a polyamide produces a harder surface which, for example is more suited for rounder substrates.

Typical transparent epoxy resins suitable as the protective coating layer wherein a polyamine hardener has been used have the following physical properties:

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Viscosity @ 25°C (cps)	600 ± 100
Hardness - Shore A @ 25°C	60 to 80
Tensile Strength (kg/cm ²)	18 to 22
Elongation at break	70 to 80 %
Thermal shock (-20°C to 120°C)	pass over 12 cycles
Weight loss - 24 hrs. @ 130°C	less than 0.5 %

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Typical transparent epoxy resins suitable as the protective coating layer wherein a polyamide hardener has been used have the following physical properties.

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Viscosity @ 25°C (cps)	700 ± 100
Hardness - Shore D @ 25°C	70 ± 5
Tensile Strength (kg/cm ²)	55 to 65

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Typical thicknesses for the protective epoxy resin layer are 0.5 to 1.0 mm but other thicknesses may be used if desired.

In accordance with the method of the invention, the substrate and informative matter are preferably treated before bonding occurs. This usually involves treatment with an abrasive, e.g. sand paper, garnet paper, either by hand or by mechanical means followed by treatment with a solvent. Suitable solvents include acetone, toluene, methanol and isopropanol. Only the surfaces of the informative matter and substrate which are adjacent to the layer of adhesive should be abraded and treated with solvent.

In accordance with the process of the invention a layer of the adhesive is laid on the substrate which is preferably held substantially horizontal. If for example the adhesive is epoxy resin about 100 parts by weight of epoxide of bisphenol A are mixed with about 40 parts by weight of the hardener i.e. a polyamine or polyamide.

Before the adhesive has set or cured the informative matter is laid on the adhesive. Thereafter, the transparent epoxy resin coating is prepared for laying on the substrate containing informative matter. Typically about 5 parts by weight of the epoxide (of bisphenol A) are mixed with about 2 parts by weight of hardener i.e. a polyamine or polyamide, and the mixture stirred thoroughly, e.g. for 10 to 15 minutes.

The epoxy resin coating is then laid on the substrate containing the informative matter. Due to the chemical reaction between the bisphenol A epoxide and the polyamine or polyamide hardener bubbles of gas will often be evolved and these should be removed before the resin has cured otherwise the finished product will have a defective surface.

Usually, the epoxy resin requires seven days to be fully cured and to reach its highest impact strength. In order that the resin shall be scratch resistant, it is advisable to dry the finished article (substrate, adhesive, informative matter and transparent epoxy resin).

The epoxy resin can be dried by ordinary ventilation. Nevertheless, to accelerate the drying process, or if the temperature is low, other ways of drying may be used, for example an oven at 40 to 50°C or light bulbs with
5 ventilation so as to keep the ambient temperature at about 55°C for about 4 hours.

Different transparent epoxy resins will require different curing conditions and the manufacturers' instructions should be observed. Typically the humidity may
10 be 75% to 90%, the temperature 25 to 30°C, tack free time 16 to 24 hours and fully cured time 1.5 to 7 days.

When carrying out the process of the invention absolute cleanliness should be observed.

The finished product of the invention especially where
15 the substrate is paper is of wide application, for example for interior design, sign, advertising, printing, computer, publishing, architectural drawings and texts etc. It has been found that the coating is clear, smooth and is not discoloured and it preserves the substrate substantially in
20 its original state.

CLAIMS

1. A substrate containing information protected from damage comprising a substrate adjacent to which is a layer of adhesive, to which is adhered informative matter comprising print, script, graphic or pictorial matter or other matter containing information and adjacent to the informative matter, a coating layer of transparent epoxy resin.
2. A protected substrate according to claim 1 wherein the substrate is paper, card, cardboard, wood, plastic film, metal, glass or marble.
3. A protected substrate according to either of claims 1 and 2 wherein the adhesive is an epoxy resin based adhesive.
4. A protected substrate according to claim 3 wherein the epoxy resin based adhesive has a viscosity in the range of from 9000 cps - 60,000 cps (9-60 Pa.s) at 25°C and is transparent.
5. A protected substrate according to claim 5 wherein the epoxy resin of the coating layer has a viscosity of less than 1000 cps at 25°C.
6. A method for protecting a surface of a substrate against damage comprises applying to the substrate, an adhesive layer, applying to the adhesive layer informative matter comprising print, script, graphic or pictorial matter or other matter containing information and applying to the layer of informative matter, a coating layer of transparent epoxy resin.
7. A method according to claim 6 wherein the substrate is as defined in claim 2.



8. A method according to either of claims 6 and 7 wherein the adhesive is as defined in either of claims 3 and 4.

5 9. A method according to any one of claims 6 to 8 wherein the coating layer is as defined in claim 5.

10 10. A method according to any one of claims 6 to 9 wherein the surfaces of the informative matter and substrate adjacent to the adhesive layer are first abraded and treated with a solvent.

11. A method for protecting a surface of a substrate according to claim 6 substantially as herein described.