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COMPOSITION COMPRISING A POLYVINYL ACETAL, A PHENOL-ALDEHYDE RESIN AND A POLYISOCYANATE, PROCESS FOR PREPARING SAME, AND ELECTRICAL CONDUCTOR COATED THEREWITH

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This invention relates to polyvinyl acetal coating compositions. More particularly, this invention relates to coating compositions comprising polyvinyl acetals, phenolic resins and certain polyurethanes.

Polyvinyl acetals modified with phenolic resins are well known being used extensively as coatings in various applications such as can linings and as electrical insulations. They are also used as structural adhesives, particularly as taught by de Bruyne in U.S.P. 2,499,134. A delicate balance of many varied properties is required for these applications and much work has been done to improve the characteristics desired since the formulations were first shown by Jackson and Hall in U.S.P. 2,307,588.

Some recent work is disclosed by Daszewski in U.S.P. 2,730,466, Emig et al. in U.S.P. 2,668,157 and Anderson in U.S.P. 2,574,313. Most of the new compositions have included extremely minor amounts of various additives to improve the preferred commercial compositions comprising generally 100 parts of polyvinyl acetals and 50 parts of phenolic resin.

The present inventors have revealed new coating compositions in Australian Patent 206,454, issued Feb. 20, 1957 (U.S. Ser. No. 494,535 filed March 13, 1955) which comprise polyvinyl acetals with certain polyurethanes. These compositions possess the solderability lacking in the phenolic modified polyvinyl acetals. The present application is a continuation-in-part of our prior application Ser. No. 494,535 filed on March 5, 1955.

An object of this invention is to provide polyvinyl acetal compositions with improved resistance to various organic solvents.

Another object is to provide coating compositions with improved heat life as measured by flexibility and dielectric strength. A still further object is to obtain improved cut-through temperatures.

A particular object of this invention is to provide improved wire enamels for use as electrical insulation.

These and other objects are attained with coating compositions comprising 100 parts polyvinyl acetal, 1–50 parts heat-hardenable phenol-aldehyde resin and 2–80 parts blocked polyisocyanates.

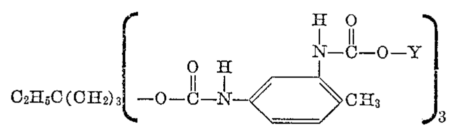
This invention is illustrated but not limited by the following examples in which the parts are by weight. The examples listed as controls do not contain a polyisocyanate and are typical commercial polyvinyl acetal-phenol-aldehyde wire coating compositions.

	Phenol-aldehyde resin, parts	Blocked polyisocyanate, parts	Polyvinyl formal, parts
Ex. 1	10	60	100
Ex. 2 (control)	50	----------	100

The phenol-aldehyde resin was produced by refluxing a

mixture of 100 parts of commercial cresylic acid (a mixture of meta and para cresols with a minor amount of xylenols) 60, parts of formalin (an aqueous solution containing 37% formaldehyde) and 3.2 parts triethanolamine at about 80° C. for about 2.5 hours. The reaction product was thereupon dehydrated under vacuum and the resin obtained as a dark viscous liquid.

The blocked polyisocyanate was a polyurethane represented by the formula



where Y is a meta methyl phenyl group.

The polyvinyl formal contained about 10% acetate groups calculated as polyvinyl acetate, about 6% hydroxyl groups calculated as polyvinyl alcohol and the remainder was substantially formal groups.

The material in Examples 1 and 2 were dissolved in a mixture of 170 parts high solvency coal tar hydrocarbons (B.P. 150–200° C., composed principally of alkyl benzenes, approximately 80% being trimethyl and tetramethyl benzenes) and 100 parts of cresylic acid. (The phenol-aldehyde resin is obtained commercially as a solution in cresylic acid. The amount of phenolic resin indicated in the example is without any solvent; whatever solvent was incorporated with this resin is included in the solvent totals indicated.)

Copper wire having a diameter of about 0.05 inch was coated with these compositions and cured by conventional means as is well known commercially in the field of wire insulating and as is shown in U.S.P. 2,307,588. The curing temperature was about 350° C. in a 3 to 4 foot zone of a twelve foot vertical oven. Six successive coatings were dried and cured on the wire.

Samples of the coated wire were thereupon crossed at 90° and a load of 5 pounds was placed at the junction. The temperature was raised at a rate of 10° C. per minute until shorting at the junction closed an indicator circuit thereby determining the cut-through temperature.

The cut-through temperature for Example 1 was over 260° C. while for Example 2 it was 212° C. indicating that the presence of the blocked polyisocyanate raised the cut-through temperature of conventional phenolic modified polyvinyl acetal coatings drastically.

All other properties of these coatings were practically the same.

Similar insulative coatings on copper wire were prepared from the compositions in the following examples.

	Phenol-aldehyde resin, parts	Blocked polyisocyanate, parts	Polyvinyl formal, parts
Ex. 3	5	45	100
Ex. 4	2.5	67.5	100
Ex. 5 (control)	50	----------	100

The percent extractibles of the insulative coatings produced were determined for various solvents.

Methanol and toluene extractibles of the coatings were determined by measuring the loss of weight of a coated wire after being immersed for 2 hours at reflux in the respective solvent and dried for one hour at 150° C. in a mechanical conventional oven.

$CHClF_2$ extractibles were determined by placing the coated wire in a siphon cup and exposing the coating to the solvent for 6 hours at about 225 p.s.i. (40° C.) and drying similarly.