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VC copolymer 40

chlorinated binder, resistant to hydrolysis, for the manufacture of printing inks and road marking paints

Nature

copolymer based on vinyl chloride and vinyl isobutyl ether

Properties

Supply specification

viscosity of a 20% solution in toluene at 23 °C (73 °F) (ISO 3219, DIN 53019/53214, shear rate D = 500 s^{-1})	30–60 mPa·s

Other properties

density at 20 °C (68 °F) (ISO 2811, DIN 53217)	1.24 g/cm^3
glass transition temperature (dynamic mechanical thermal analysis, DMTA)	~ 50 °C (122 °F)
chlorine mass fraction	44 %

Physical form

fine white powder

Storage

Protected from heat and moisture, VC copolymer 40 can be stored for six months.

Application

VC copolymer 40 can be used as a binder in printing inks for paper and numerous plastic films, for road marking paints and for the impregnation and coating of paper, cardboard and textiles. It can be combined with aldehyde and ketone resins, polyvinyl ethers, polyacrylates, chlorinated polyolefins as well as with many alkyd resins.

Overview

VC copolymer 40 offers advantages to both manufacturers and users of printing inks:

- solubility in a multitude of solvents
- good compatibility with other raw materials
- good pigment binding capacity
- unrestricted choice of pigments

Choosing the right solvent

Suitable solvents are aromatic hydrocarbons, esters or blends with glycolether acetates. Aliphatic hydrocarbons and/or alcohols are used as diluents.

Ketones in general are less suited since they are retained by vinyl chloride polymers longer than other solvents with equal volatility, resulting in slower drying coatings.

The diluent fraction of the solvent blend mainly depends on the solvency of the true solvent.

When VC copolymer 40 is combined with raw materials that are well compatible with it and which are soluble in aliphatic hydrocarbons or alcohols, the fraction of diluent can be increased. Examples of such raw materials are hard resins such as Laropal® A 81, many alkyd resins, soft resins and larger quantities of plasticizers.

Highly volatile solvents and/or diluents produce coatings which dry faster. Formulations containing a blend of xylene and butanol instead of xylene alone will dry faster. Polymers release esters more easily than ketones and aromatic hydrocarbons of the same volatility. The most favorable low-volatile solvent is ethoxypropyl acetate. Note that the solvent retention also depends on the other constituents of the formulation.

Gloss and flow of coatings can be improved by adding high-boiling solvents, e.g., ethoxypropyl acetate. High proportions of lowly volatile diluents, however, may result in precipitation of binder constituents, impairing both gloss and mechanical properties of the films.

Clear or almost clear solutions can be obtained in aromatic hydrocarbons such as toluene, xylene or Solvesso®[1] 100 as well as in chlorinated hydrocarbons, anone and tetrahydrofuran. Solutions with other solvents may be somewhat cloudy but will not adversely influence hardness and homogeneity of the film, provided the solution dries to form a clear film.

Viscosity behavior of the solution

The higher the temperature as well as duration and extent of shear forces, the lower the viscosity of the solution will be after cooling down to room temperature. After extended storage, the viscosity may increase again, an effect that is more pronounced the less the solvating power and the affinity between solvents and polymer.

Unpigmented concentrated solutions of VC copolymer 40 in xylene may tend to gel – often only months after they have been prepared and without undergoing a gradual increase in viscosity. Adding ketones and esters reduces the tendency to gel, in particular if the binder concentration is high. By adding 10–20 % of an alcohol to the solvent blend, gelling generally can be suppressed completely. Likewise, no gelling has been observed yet in formulations con-

[1] registered trademark of Exxon Mobil Corporation

taining blends of high-boiling aromatics such as Solvesso®[1] 100 or Shellsol®[2] A. The gel structure can be removed by intensive stirring, heating or by milling with pigments.

Typical solvent blends

a)	80 %	xylene
	20 %	white spirit 155–185 °C
b)	50 %	ethoxypropyl acetate
	50 %	white spirit 155–185 °C
c)	90 %	xylene
	10 %	ethoxypropyl acetate
d)	90 %	xylene
	10 %	n-butyl acetate
e)	90 %	xylene
	10 %	iso-butanol

Plasticizing

VC copolymer 40 is internally plasticized and yields coatings with good flexibility and adhesion even on its own. Proportions of additional plasticizers may therefore be kept comparatively low. In general, mass proportions of 10–25 % are sufficient. Plasticizers with good solvating power, mostly low-viscous (e.g., Plastomoll® DOA), can be added in low proportions of 5–15 %, soft resins (e.g., Acronal® 4 F or Lutonal® A 25) in larger proportions of 15–30 %. Too much plasticizer will impair the hardness and thermostability of the dried coatings.

Acronal® 4 F, Lutonal® A 25 as well as the Lutonal® A 50 or Lutonal® M 40 grades are particularly suitable to increase adhesion to aluminum and its alloys and other difficult substrates.

Modification by hard resins

Solids content, gloss and adhesion can be increased by adding hard resins.

Suitable are aldehyde and ketone resins such as Laropal® A 81 and Laropal® K 80, chlorinated polyolefins and ethyl/vinyl acetate copolymers (EVAs) as well as coumarone, indene and hydrocarbon resins. Saponifiable hard resins (e.g., maleate or modified phenolic resins) can be used if good resistance to chemicals is not required.

Hard resins which are compatible with VC copolymer 40 such as Laropal® K 80 or Laropal® A 81 are often able to overcome any slight incompatibility on the part of other materials present in the formulation. Laropal® K 80 and Laropal® A 81 increase the diluent tolerance for aliphatic hydrocarbons of coatings based on VC copolymer 40.

Stabilizers

Generally, coatings systems based on VC copolymer 40 should not be exposed to heat above 70–80 °C (158–176 °F) for prolonged periods.

Adding 2 % Mark®[3] 17 M and 3 % Drapex®[3] 39 (respective to VC

[2] registered trademark of Shell Chemicals Group

copolymer 40) provides adequate stabilization.

Dispersants, antisettling agents, thixotropes

Some dispersants or antisettling agents, particularly in higher proportions, may act with chlorinated binders to cause corrosion of metal containers and thus reduce the coating's anticorrosion protection. Trials are recommended.

Thixotropes derived from hydrogenated castor oil (e. g., Luvotix®[4] or Thixatrol®[5] ST) can be used. Gel pastes of approximately 10 % Bentone®[5] 38 or Bentone®[5] 39 and Anti-Terra®[6] U in aromatic solvents are suitable thickeners and antisettling. Manufacturer's instructions on their use should be observed for best results.

Processing

VC copolymer 40 dissolves very rapidly even without heating. Dissolving the powder in blends of solvents and diluents is quickly done by following this procedure: add diluents (aliphatic hydrocarbons, alcohols) to the mixing vessel, then add the polymer powder while stirring slowly and consistently to disperse the powder fully and lump-free. Proportions of VC copolymer 40 powder and diluent should be approximately equal. Then add the solvent(s) and other diluents while stirring consistently. Subsequently, plasticizers and combination resins may be added.

Solutions of VC copolymer 40 that contain plasticizers and possibly other binder components are used to paste and mill pigments. If alkyd resin cobinders are present in the formulation, these can be used to prepare the pigment paste.

Fields of application

Printing inks

VC copolymer 40 is particularly suitable for lamination gravure printing inks based on toluene or ethyl acetate. Due to its limited solubility in alcohols, VC copolymer 40 is less suitable for alcohol-based inks such as flexographic inks.

Road marking paints

Road marking paints can be formulated from VC copolymer 40 alone or combined with air-drying binders. Note, however, that air-drying binders will reduce the life of road markings.

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[3] registered trademark of Crompton Vinyl Additives
[4] registered trademark of Lehmann & Voss & Co.
[5] registered trademark of Elementis plc
[6] registered trademark of Byk-Chemie GmbH

Safety

When handling these products, advice and information given in the safety data sheet must be complied with. Further, protective and workplace hygiene measures adequate for handling chemicals must be observed.

Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out their own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for a specific purpose. Any descriptions, drawings, photographs, data, proportions, weights, etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed.

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