

Construction and Material For Food Science Engineering

Protective Coated Materials

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Protective Coated Materials

Protective coated materials: Engineering materials, usually after construction or fabrication (like building, machine, equipment) need to be protected from deterioration. For this purpose a protective coating is used over the surface of the materials. A large number of organic compositions are available (in the market) for this purpose, which are called protective coated materials.

Classification: Organic protective coating materials may conveniently be grouped as:

- Paints,
- Enamels,
- Varnishes, and
- Lacquers,

➤ **Paints:** Fourfold purposes of Paints are:

- Preserve the material coated,
- Produce a pleasing appearance,
- Improve sanitary conditions, and
- Obtained better distribution of light,

Paints

Composition of Paint: Paints essentially consist of-

1. Base,
2. Vehicle,
3. Pigment,
4. Drier, and
5. Thinner

1. Base: The base of a paint is its principal constituent forming its body. The base forms an opaque layer to obscure the surface of the materials to be painted.

Example: The materials commonly used to form the base of paints are:

(a) white lead	(e) graphite
(b) zinc white	(f) lithophone
(c) red lead	(g) antimony white
(d) iron oxide	(h) titanium oxide

Paints: Base Materials

Most commonly used base materials:

(a) White lead: White lead is a **carbonate of lead**. It is most commonly used base for building works. It is available both as a **powder form** and in the form of a **stiff paste containing 8% linseed oil**. The great advantage of using white lead is that it is cheap and can be easily applied, and it has property of obscuring the surface to which it is applied, it produces an elastic film which reduces the possibility of cracks in the covering film applied to the surface. It is waterproof and is very well suited for application to timber surface. However, it darkens on contact with air containing sulphurette hydrogen and therefore it cannot be used for the top coats. It is very poisonous and proper care should be taken in mixing.

(b) Zinc white: It is an **oxide of zinc** and is more commonly used. It is non-poisonous and is unaffected by weathering actions. It retains its color well and takes a fine polish, and is commonly used for interior decorations. But it is very costly.

Paints: Base Materials

Most commonly used base materials (Contd.):

(C). Red lead: It is a higher **oxide of lead** which is available as a rust colored powder. It retains this color permanently. It is very heavy and very often used for the first coat on wood work and as a base coat to iron and steel works to prevent formation of rust.

(d). Oxide of Iron (known as **red oxide of iron**): It is used as a base for paints to be applied to iron and steel works. Oxide of iron is often preferred as it also prevents the formation of rust. It is comparatively cheap.

Paints: Vehicle and Pigments

2. Vehicle: The function of a vehicle is to contain all materials of a paint and to allow them to be applied on the surface to be painted. **Linseed oil** of various grades is the main vehicle used in our country in making of paints. **Linseed oil contains acids which react readily with oxygen and harden by forming a thin film. Boiled linseed oil dries more quickly than the raw linseed oil.** Linseed oil becomes thicker on boiling and therefore, the double boiled oil requires the **addition of a thinning material which is usually turpentine.** Other oils which can be used as vehicle are **wood oil, nut oil, dehydrated castor oil, soya bean oil, cotton seed oil, and fish oil.**

3. Pigments: Pigment is a coloring ingredient which **gives desired color to the paints.** Pigments are available in the form of fine powders. The particles of pigments should be in completely wetted condition and duly dispersed in the vehicle. The pigments of various colors are given in table.

Paints: Colors and their Pigments

Color desired	Name of pigment
White	White lead, zinc oxide, lithophone, titanium oxide
Blue	Iron blue, ultramarine, cobalt blue, sublimed blue lead, indigo,
Green	Chrome green, paris green, cobalt green, hydrated chromium oxide,
Yellow	Chrome yellow (lead chromate), zinc yellow, cadmium yellow,
Orange	Mixture of chrome yellow and red pigments of basic lead chromate
Brown	Umber, sienna, copper oxide
Red	Red lead, cadmium red, iron oxide, mercuric oxide, carmine, vermilion,
Black	Lamp black, carbon black, drop black, graphite, ivory black,

Paints: Dryers and Thinners

4. Dryers: The function of a dryer is to absorb oxygen from the air and to supply it to the vehicle to dry and harden through the process of oxidation.

- Dryers generally are of three types:
 - A. Soluble dryers which are dissolved in linseed oil,
 - B. Paste dryers which are dryers mixed with certain inert fillers (termed as extenders) such as baryte/barite (BaSO_4), whiting etc. ground to a paste in linseed oil,
 - C. Liquid dryers which are dryers dissolved either in linseed oil or in turpentine or in both,

Litharge (one of the natural mineral forms of lead(II) oxide, PbO , **lead monoxide**) is the commonest form of dryer. It is used generally for lead paints. **Lead acetate, manganese dioxide, zinc sulphate and manganese sulphate** are the other types of dryers.

5. Thinners: A thinner is a solvent added to paints to obtain a product of desired consistency. It helps the paints to be spread uniformly on the surfaces. The thinner evaporates and dries the paints consequently. The common thinners for oil-based paints are **turpentine, naphtha** and various petroleum thinners of low boiling range.

Turpentine is a fluid obtained by the distillation of resin from live trees, mainly pines

Paints: Types of Paints

Types of paints:

1. Oil paints: Oil paints are not ready mixed paints. These paints are to be prepared with all the ingredients. The base should be thoroughly ground in oil and thinned by the addition of oil and turpentine. The pigments are separately ground with oil until thoroughly mixed and rendered blind by the addition of turpentine. The two mixtures of the base and pigments are then mixed together and full quantity of turpentine and oil is added to make the paint workable.

2. Water Paints: Water paints include those paints of which the medium is water. They are prepared with medium containing both oil and paint to which a certain amount of glue is added to form the emulsion of oil in water. Water paints are used only for interior works or for the decoration of exterior surfaces.

3. Aluminum Paints: These consist of very finely ground aluminum suspended in a medium of slow drying oil varnish or spirit varnish. These are expensive white paints and usually used for decorative works. It protects iron and steel from corrosion far better than any other paints. It can resist heat to great extent. It is especially used for painting marine piers, oil tanks, gas tanks, radiations and hot water pipes.

Paints: Types of Paints

4. Cellulose Paints: Cellulose paints differ from other paints in the process of drying which is entirely affected by evaporation of the solvent without any chemical change being involved. Such paints are mainly used for **motor cars**, aeroplanes and also for the decoration of prefabricated fittings. They are commonly termed as **spray paints**. They are made from nitrocotton, celluloid sheets, photographic films etc. These paints possess great hardness, smoothness and can stand extremes to temperature. They can be easily washed and cleaned.

5. Water-repelled Cement Paints: These paint are used for providing a water-proof coat to external as well as inter walls of buildings. They can be applied on any surface. They generally consist of white cement incorporated with some water proofing agents (soaps, heavy mineral oils, fluosilica-tea, lime and petroleum jelly), antifungus agents (mycol, complex emulsions, etc.) and some binding agents.

Paints: Types of Paints

6. Distempers: It is a form of water paint which contains water and oil as its thinning agents. Glue, starch and resin are used as base together with a pigment to suit the desired colour. Distempers are used to all interior surface of buildings for decorative purposes. Distempers are easily washable.

Distempers are of 2 types:

- a. **Oil bound distempers** which are generally available in the form of pastes and they are thinned before use by the addition of water.
- b. **Ordinary distempers** (not containing oil) which are available in the form of powder and they are to be mixed with water before use according to the instruction of the manufacturer.

7. Others: There are some other paints available in the market such as enamel paint, lead paints etc. Their preparations and uses procedures are mentioned on the manufacturers' instructions.

Protective Coating Materials: Enamels and Varnishes

- **Enamels:** An enamel is made by suspending pigments in a varnish. An enamel can make a smooth film over the surface where applied. The amount of pigment in enamel is usually much less than in paints. A much higher degree of dispersion of the pigment in the vehicle is required in enamel than is generally necessary with paints. The enamel contains the same ingredients as those of paints but in different proportions. Enamel and paint serve the same purpose.
- **Varnishes:** Varnishes do not contain any pigment. Varnishes consist of melted resin dissolved in hot linseed oil, turpentine or alcohol. They are liquid composition which may be converted to transparent or translucent solid film after application in a thin layer. Varnishes dry quickly and brighten painted surfaces and protect them from the atmospheric action. They are most commonly used for brightening the plain surfaces of timber in furniture and other building works.

Protective Coating Materials: Varnishes

Classification of Varnishes

Varnishes are of two types: 1. Oil varnishes and 2. Spirit varnishes.

1. Oil Varnishes: Oil varnishes contain resins, oils, dryers and thinner. The resin is melted and heated oil is added to it together with necessary dryers. Turpentine and oil are added to bring it to a required consistency. Oil varnishes are generally applied to exposed works. Composition of oil varnishes are as follows

Resin (natural)	Oil	Dryer	Thinner
1. Congo copal	Linseed	Active dryer	Turpentine
2. Kauri copal	China wood Tall	Cobalt	Mineral spirits
3. Boca copal	Dehydrated castor copal	Manganes	Naphtha
4. Pontianak copal	Soya bean	Auxiliary dryers	Benzine
5. Shellac	Fish	Higher alcohols	

Protective Coating Materials: Varnishes

1. Oil Varnishes (contd.)

Among the oil varnishes for common works, copal varnish is considered to be the best. Copal varnish is suitable for protecting exposed surface of timber, iron and steel works. Copal can be prepared in different way as follows:

Option: 1	Option: 2	Option: 3
Copal resin = 2 parts	Copal resin = 3 parts	Copal resin = 2 parts
Linseed oil = 2 parts	Linseed oil = 3 parts	Double boiled linseed oil = 3 parts
Turpentine = 1 parts	Turpentine = 5 parts	Turpentine = 1 part
		Bees-wax = 1 part

2. Spirit varnishes: spirit varnishes are solutions of one or more resins in volatile liquids. These are prepared by dissolving gums and resins in methylated spirits. These varnishes are commonly used in Bangladesh.

Protective Coating Materials: Varnishes

Laquers: *Laquer is the term used to designate an organic coating dries by the evaporation of solvents and thinners, leaving a film of material which was present originally in fully polymerized form.* Or, a liquid made of shellac (resin) dissolved in alcohol, or of synthetic substances, that dries to form a hard protective coating for wood, metal, etc.

4. Resin: a sticky flammable organic substance, insoluble in water, exuded/secreted by some trees and other plants (notably fir and pine). **Resins** are soluble in organic solvents (such as ether) but not in water and **are** used as the basis of plastics, adhesives, varnishes, or other products. In addition to organic resin there are also developed some synthetic resin like Alkyd resin, Phenolic Resin are used with organic resin.

2. Shellac: **Shellac** is a resin secreted by the female lac bug, on trees in the forests of India and Thailand. It is processed and sold as dry flakes and dissolved in alcohol to make liquid **shellac**, which is used as a wood finish. Shellac is used mainly in spirit varnishes. Commercial shellac is orange in color. By bleaching with sodium hypochlorite white shellac is produced which is called bleached shellac.

Thanks