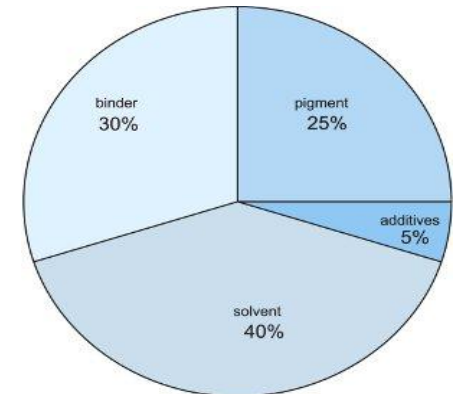
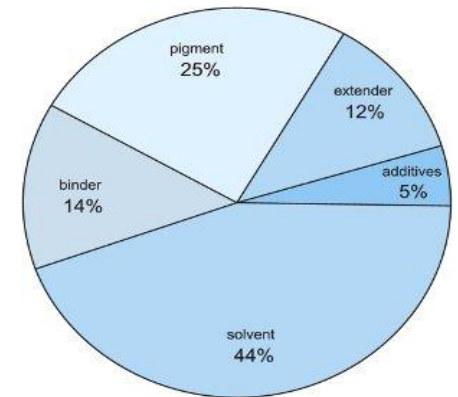


PAINTS, ITS CONSTITUENTS & FUNCTION



white gloss (alkyd) paint



white matt emulsion paint

OBJECTIVES

To:

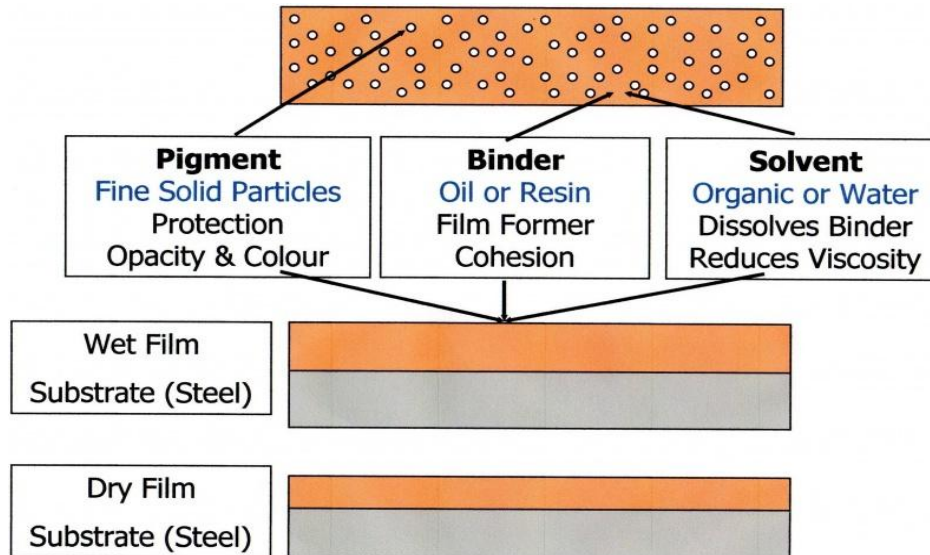
- Understand the:
 - Definition & properties of paint
 - constituents of paint, their properties & functions

PAINT

Definition:

“Paint is defined as a unique homogeneous mixture of three major ingredients namely Binder, Pigment, VOC & additives, which when applied on the surface as a thin layer that forms a solid dry adherent film after oxidation/evaporation/ polymerisation”.

- In the broadest terms, a paint consists of a particular pigment, dispersed in a particular binder, dissolved in a particular solvent
 - In general the corrosion protection afforded by a paint film is ∞ to its DFT measured by **Elcometer**-an electro-magnetic induction gauge
- *Adhesion: the degree of attachment between film & the substrate



PROPERTIES OF PAINT

Properties:

- It should have high hiding power & the required colour
 - It should be able to resist the atmospheric conditions to which it will be put
 - The films produced should be washable
 - It should resist corrosion
 - It should have the necessary consistency (property to resist permanent change of shape) for a particular purpose for which the paint is to be used
 - The film produced by applying the paint on a surface should have gloss
- *All the requirements can be obtained in a paint by properly choosing the proper pigments, extenders, binders and their quantities. There is no set methods for doing so.

PURPOSE OF PAINT

Purpose:

- To avoid loss of metal due to corrosion
 - Protects the metal surfaces from the corrosive effects of weather (sun, wind, rain, frost, atmospheric pollution & other natural elements), heat, moisture, gases etc.
- Delays in rusting
- Provides:
 - aesthetic look to materials
 - a smooth surface for easy cleaning

CONSTITUENTS OF PAINT

Paints are variable combinations of :-

- Binder
- Pigment
- Filler/ Extender
- Volatile organic compound (Thinner)
- Driers
- Additives (Anti skinning agents, Anti settling agent, Plasticizers, fire retardants etc)

BINDER

“Binders are usually resins or oils but can be inorganic compounds”

- The actual film forming component & absolutely required ingredient of any paint”
- Consists of a resin and a solvent thinner
- It is the part which solidifies to form the dry paint film when the solvent evaporates
- Non-volatile & mainly polymers of various types. They are alkyd, epoxy, polyurethane resins etc
- Different resins form dry film on the substrate in different manners
- **Alkyd** resins (**widely used binders**) form dry film simply by volatilization as well as by oxidation in presence of air
- **Epoxy** & **PU** resin mainly dry through chemical reactions

BINDER

- Purpose:
 - Binds pigment, fillers & additives together
 - Imparts adhesion & strongly influences:
 - Gloss
 - Durability
 - Flexibility
 - Toughness
- Binders include resins:-
- Alkyds, Polyurethanes (PU), Epoxy, Polyesters

Binder



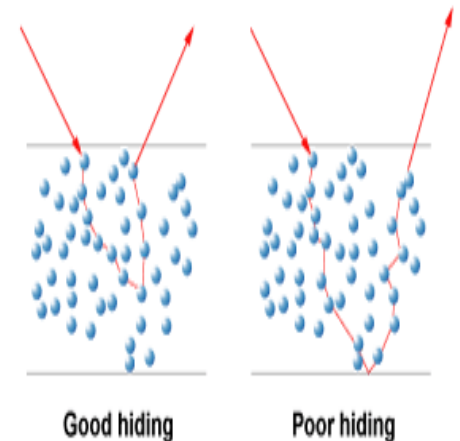
PIGMENTS

“Pigments are finely ground inorganic or organic powders of higher RI (> 1.5)

- Higher the RI, more the light is bent & greater the opacity
- Good opacity has good lighting absorbing & /or scattering properties
- Average diameter ranges from 0.01 to 5 μ



HIDING POWER



PROPERTIES OF PIGMENT

- Should be opaque so that it may have good covering power.
 - When a coating is opaque the pigment particles scatter &/or absorb light sufficiently to prevent it from reaching the substrate
 - Opacity depends on two characteristic properties:
 - **Refractive Index (RI)**
 - If the particles do not have a high RI, less the bending of light travelling & thus insufficient hiding of the substrate.
 - **Particle size:**
 - Particle size has also an effect on the effectiveness of the pigment. As the particle size decreases , opacifying ability increases.
- Should be non-toxic so that they have no bad effect on health of painter & inhabitants

PURPOSE OF PIGMENT

Purpose:

Pigment plays a major role to attain the following essential properties of paint system

- provides colour, opacity, film cohesion and sometimes corrosion inhibition
- provides aesthetic look to the paint
- obliterates the substrate and previous colour on the substrate, if any
- protects the film by reflecting the destructive UV light

PIGMENTS

Widely used pigments:

White Lead, Zinc Oxide, Titanium Dioxide, Red Oxide, Carbon Black, Prussian Blue, Chrome Yellow, Aluminium powder etc.

* [Titanium dioxide is extensively used because it has good covering power).

Titanium is an excellent reflector of infrared].

EXTENDER/FILLER

Non-expensive commonly natural inorganic materials added to the paint in order to increase its volume. (RI <1.5)

- Extenders are mainly inorganic substances & do not provide colour to the paint but added to improve adhesion, ease of sanding and film strength
- As they are cheap in comparison to prime pigments, they reduce overall cost of the paints
- Average dia: up to 50 μ



EXTENDER/FILLER

Properties:

- Do not provide colour
- Poor optical properties (reflectance, opacity, etc)
- It improves adhesion
- If extender pigment added are of needle shaped or flaked shape, the settling may be very little

Purpose:

- thickens the film
- Increases volume, paint film thickness
- reduces cost of the paint
- imparts toughness, abrasion resistance & texture
- Control consistency

Widely used fillers:-

- Calcium carbonate, Gypsum, Ground silica, Barytes, Slate powder, French chalk, china clay, asbestos, silica, mica, whiting etc.

VOC/THINNER

“Liquid used for viscosity adjustment for correct application”

- Used to dissolve the binder and to facilitate application of paint. Solvents are
- usually organic liquids or water.
- not a part of the paint film.
- Excessive thinner dulls the colour & gloss
- Most hazardous due to its toxicity & flammability
- Once the solvent gets evaporated, the remaining paint is fixed on to the surface

Purpose:-

- Control flow and application properties
- Act as carrier for binders & pigments
- Help penetration into porous surfaces
- Used to clean brushes & other painting tools

VOC/THINNER

Widely used thinner:

- Turpentine oil (distilled pine tree sap): the most commonly used thinner
- Benzene & Naphtha: as substitute.
- Mineral spirit, acetone, carbon tetra chloride, ethyl alcohol

DRIERS

- Depending upon the nature of the solvent and film thickness, the drying process may take as long as several hours.
 - Thicker the film, longer the drying time. If the drying process is artificially accelerated, there may be problems with adhesion between the protective film and the metal surface.
- Metallic salts of Lead, Manganese, Cobalt, etc. of organic acids
 - Easily soluble at ordinary temp
 - Added in small quantity
 - One drier should be used at a time
 - Added to the paint just before use.

Purpose:-

- to accelerate the drying process.

Examples:-

- Lead acetate, Cobalt octate, Manganese octate, Litharge, Red lead, Lead octate, Manganese dioxide, Zinc sulphate, etc.

CORROSION INHIBITOR

“A compound which prevents corrosion by forming a metal oxide layer”

- The surface becomes passivated.

Purpose:-

- To protect the substrate from corrosion

Commonly used corrosion inhibitors:

- Sodium molybdate
- Zinc molybdate

ADDITIVES

“**Additives** are small amounts of different chemical substances improving or modifying the paint properties.

- Added to a paint in amounts 0.001% & ≤ 5% & have a profound influence on physical & chemical properties of the paint
- Prevent clustering of pigments
- Surfactants such as polyoxyethylene ethers of dodecyl alcohol, e.g. $C_{12}H_{25}O(CH_2 \cdot CH_2 \cdot O)_6H$ is added to attain compatibility of different material in the paint system

ADDITIVES

- **Driers** accelerate the paints drying (hardening) by catalyzing the oxidation of the binder.
- **Plasticisers** (liquids of mol wt higher than that of solids to limit volatility) increase the paints flexibility, durability, compatibility & minimise film cracking
- **Fungicides, Biocides and Insecticides** prevent growth and attack of fungi, bacteria and insects. (protect the paint in storage from spoilage due to bacterial growth)
- **Flow control agents** improve flow properties.
- **Defoamers** prevent formation of air bubbles entrapped in the coatings.
- **Emulsifiers** are wetting agents increasing the [colloidal stability](#) of the paints in liquid state.

ADDITIVES

- **UV stabilizers** provide stability of the paints under ultra-violet light.
- **Anti-skinning agents** prevent formation of a skin in the can.
- **Adhesion promoters** improve the adhesion of the coating to the substrate.
- **Corrosion inhibitors** reduce the corrosion rate of the substrate.
- **Texturizers** impart textures to the coatings.
- Antifreezers helps to withstand exposure
- Pigment stabilizers improve pigment stability
- Fire retardant properties
- Anti settling

Thank You

Have a nice day!
