

WEEK 10

GLASS.

GLASS:-

"Glass is homogenous substance having uniform texture."

Properties

- Glasses are usually hard, brittle & transparent.
- Glasses are used to protect the UV light into buildings & as opening in door & windows.

Constituent of Glass:-

The following constituents are used in manufacturing of glass.

- Silica.
- Lime
- Soda.
- Potash.
- Lead Oxide.
- Cullet.

→ Silica:-

It is used in form of pure quartz, sandstone or pulverized flint (A stone containing pure silica).

- It usually melts at high temperature so we add sodium & potassium in order to lower down its temperature to be melt.

→ By adding these it also improves viscosity & durability of viscous silica

(*) The silica used should be iron free for best quality of glass.

2. Lime:-

It is used in glass in form of limestone, chalk or pure marble

→ It imports durability & toughness to glass.

→ It makes glass fluid and suitable for blowing, pressing, rolling & spinning.

Disadvantages:-

Too much silica makes the molten mass thin for fabrication.

(3) Soda:-

It acts as accelerator for fusion of glass.

→ Excess of soda is harmful.

(4) Potash:-

Potash adding makes glass fire resistant.

(5) Lead Oxide:-

→ It is used to import colour, brightness & shine.

→ 15-30% added decrease melting point & increase durability while decrease transparency & make glass brittle & crystalline

⑥ Cullet's:-

These are used in glass as flux to prevent loss of alkali by volatilization during process of glass forming.

→ It also reduces fusion temperature

→ The disadvantage of cullets is that it makes glass water soluble and make it crystalline.

Manufacturing of Glass:-

Glass is manufactured in following steps.

- Melting.
- Forming & shaping.

(1) Melting:-

On this process silica, lime and sand are added in definite proportion and heat it in a furnace up to 1200°C .

• Bubbles appear at surface of viscous watery liquid.

• When CO_2 are removed decolourizer such as MnO_2 are added to Carbon & Ferrous Compounds.

• The Colouring salts are added at this stage.

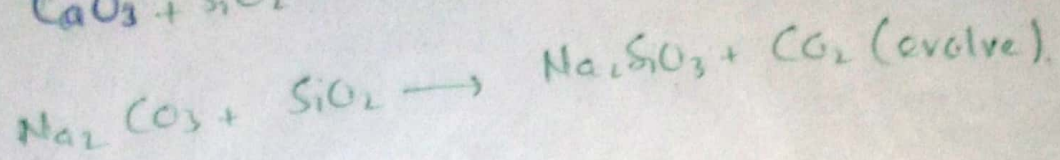
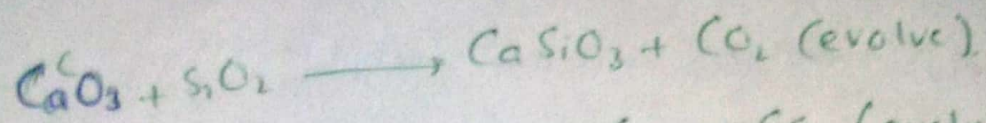
• Heating is continuous till the bubbles disappear.

• As the glass cools down it should be

given desired shape & thickness.

Reactions:-

The chemical reactions that occur during formation of ordinary glass;



2. Forming & shaping:-

The shape that is desired can be obtained by one of the following methods.

(a) Blowing:-

This process takes place in 2m long & 12mm diameter blow pipe in which the molten glass is filled.

→ It is held vertical and vigorously blown by operator.

→ Then it is coiled, which give the shape of pipe in which it is kept.

(b) Flat drawing:-

(3) Compression Molding:-

In this process moulds are used to obtain article of desired shape.

(4) Spinning:-

In this process the molten glass is filled in machine that spin.

- the glass obtain in this process is very fine
- such glasses are used for heat and sound insulation.

(5) Annealing:-

This is slow process of cooling glass in order to relieve stresses.

- In this process the glass is passed through different stages where temperature decreases gradually which cause slowly cooling & uniformly

(*) If it is cooled suddenly then external surface of glass cool but internal glass layer still hot which will expand that will cause cracks.

⑥ Finishing:-

After annealing process, The glass article is cleaned, ground, polish and cut according to our requirement.

Types of Glasses:-

(1) Sheet Glass:-

It is transparent glass usually in rectangular form.

→ It is obtained from molten glass and shape it into cylinder.

→ The ends of cylinder so produced cut away and cylinder is flattened over a plane tray.

→ Its available thickness are 2, 2.5, 3, 4, 5, 5.5 & 6.5 mm.

Uses:-

It is used for glazing doors, windows and other partition.

Plate Glass:-

It is obtained by pouring molten glass on casting table and level it to uniform thickness.

It is then smoothen & polish.

→ The glass obtained is usually clear & flawless.

→ It is available in 3 to 32 mm thickness.

Uses:-

→ It is used for all engineering purposes.

(*) It is superior from sheet glass.

→ Also different from sheet glass in that it has parallel & distortion free surface obtained from grinding & floating process.

Types of plate glass:-

(a) Ground glass quality:-

use in show case, cabinet, counter etc.

(b) Selecting glazing quality:-

used for making mirror.

(c) Special selected quality:-

use in high class work, wind screening vehicle

(3) Laminated Glass:-

It is made by sandwiching a layer of Poly vinyl butyral between two or more plate or sheet glasses.

→ It is actually combination of glass.

→ Also known as safety glass.

Example:-

• sound proof glass, bullet proof glass, shatterproof glass.

(1) Heat & Sound proof glass:-

In this type of laminated glass, the coloured plastic is sandwich between sheet or plate glasses.
→ It gives more resistance to heat & sound by increasing its thickness.

(2) Bullet Proof glass:-

In this type of glass vinyl & glass are sandwich in alternate layer to increase its thickness for safety purpose.

Uses:-

These glasses are used in bank, jewellery and for other safety purposes.

(3) Shattered Proof glass:-

→ The type of glass that cannot form sharp edges when break or crack.

→ Oftenly polyvinyl butyral is added in b/w layer of sheet & plate glass.

Uses:-

Used for windows, skylights, floor etc.

(4) Insulating Glass:-

The glasses that are used to block heat are called Insulating glass.

(ii) It is also known as double glazing or double glazed unit.

(iii) It is composed of two glass plates of 6-13mm thick.

- The edges of these are made round by fusion.
- These glasses reduce amount of heat loss by 30-60%.

Uses:-

These glasses are used in hospitals, offices, hotel etc where heating & cooling is required.

- Also used where temperature & humidity to be controlled.

⑤ Tempered or toughened glass:-

The glass that is made from plate glass by reheating and sudden cooled.

- It is 3-5 times stronger than plate glass.
- It is not breakable.
- More resistant to bending.
- When broken converted into small pieces.

Uses:-

- Used for protection of smart screen.
- Used in sport areas, sliding door & curtain walls.

⑥ Wired glass:-

The glass in which wires are embedded during its casting.

- usually thickness is 6 mm.
- It not fall into pieces when crack & break.
- It has higher m.p than other glass.

Example:-

- Special example of wired glass is wired refrax glass which transmit more than 100% light.

- Uses:- It is used in fire resisting doors, windows & roof.

(7) Obscured glass:-

This glass is made opaque to sunlight.

- It is also known as pattern glass.

Types:-

- Frosted glass.
- Ribbed glass.
- Rolled glass.

⑥ Coloured Glass:-

It is obtained by adding metal oxide in molten form.

- Also known as tint glass.

- It does not affect property of glass.

Example:-

For example blue glass is obtained by adding 0.1 % of Cobalt in ordinary glass.

→ Available in different colours.

Uses:-

It is used in doors, windows & kitchen etc.

⑨ Heat Absorbing glass:-

It is used to absorb harm uv light of sun.

→ It is bluish green or blue in colour.

Example:-

Common example is Calorex.

Uses:-

Used in hospitals, kitchen, railway carriage etc.

⑩ Ground Glass:-

In this type of glass one face of glass made rough by grinding.

(*) It is used to maintain privacy of occupants.

(*) It allows light at same time

Uses:-

It is used in bedrooms, toilets & other places where privacy is needed.

(11) Block glass:-

It is hollow sealed made by fusing together two halves of pressed glass during melting process.

Uses:-

- used for aesthetic purposes when light passes through it.
- Also used for partition.
- used for architecture purposes.

(12) Opal Glass:-

It is also known as milk glass.

- It is formed by adding bone ash, oxide of tin and white arsenic to vitreous sil.

Uses:-

- It is used where high thermal shock resistance & high chemical durability is needed.

(13) Enamel Glass:-

It is formed by adding calcined lead & tin oxide to ordinary glass.

Composition:-

10% Sand + 20% Calcined lead & tin oxide + 8% Potash.

(14) Optical Glass:-

It is used to block toxic ultraviolet rays to eyes.

→ It contains phosphorous, lead silicate & little cerium oxide.

Uses:-

Used for making lenses.

(15) Extra Clean Glass:-

These glasses are catalytic & hydrophillic.

→ It is stain proof & gives good aesthetic.

→ Its maintenance is also easy.

(16) Chromatic Glass:-

The glass that control transparency efficiency & protect interior from light.

→ It may be photo chromatic which is light

sensitive lamination, thermo chromatic, heat sensitive

lamination or electro chromic which electro

sensitive lamination.

Uses of Glass:-

• Used in door & windows.

• Used in furnitures.

• Used in building as partition.

- Use to transmit light inside building.
- Used as safety protect us from harmful U.V light.
- Used as renewable energy source.

Advantages of Glass:-

- The glass can absorb, emit & refract light depend upon our requirement.
- Glass can transmit 80% of light in both directions.
- Since surface is smooth so it can be easily cleaned.
- Since it cannot corrode so no changes of rusting.
- It has also no effect if raining & due to bad weather.
- Since glasses are transparent so also gives aesthetic look.
- It allows natural light to come even if doors are closed. so it saves our bills, brighten the room, bring beauty to home & boost mood of occupants.

- Glasses are electrically insulated for different
- Available in variety of colours for different purposes.
- It blocks the harmful U.V light & used for manufacturing of lenses.
- Glasses are 100% recyclable & not degrade during its cycling.
- Stable to wide range of temperatures.
- Provide good resistant to abrasion.
- (*) It makes structure sophisticated, stunning & provide beauty to structure.

Disadvantages:-

- Manufacturing of glass is high energy consuming because high temperature is needed.
- It is also costly process as raw material used are expensive.
- It breaks easily (brittle).
- Broken pieces are so sharp can also injured one.
- It is also unsafe for earthquake proven areas.

→ It absorbs heat so not suitable for hot & cold places.

→ Once cracks are produced, They spread easily.