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Glass is an amorphous solid, like liquids, amorphous solid have a tendency to flow, though very slowly. Therefore, some times these are called pseudo solids or super cooled liquids.

CERAMICS

"A ceramic is an inorganic non-metallic solid prepared by the action of heat and subsequent cooling."

The word ceramic comes from the Greek word "Keramikos" which means "burnt material".

Raw materials:- Majority of raw materials used by ceramic industries are oxides of metals, clay, flint and feldspar are most widely used and referred to in the industry as "Classical ceramic bodies"

Ceramics are classified into three categories:-

Oxides: Alumina, Zirconia $\rightarrow \text{ZrO}_2$
Non-Oxide: Carbide, boride, nitrides, silicides $\rightarrow \text{KSi}$ (silicon with more electropositive element)
Composites: particulate reinforced (combinations of oxides and non-oxide)
Handwritten notes: Al_2O_3 above Alumina; SiB_2 above boride; CaC_2 above Calcium carbide; Ca_3N_2 above nitrides.

Clay: - Clays are hydrated aluminosilicates ($\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$). Clay provides plasticity to facilitates the fabrication of material in to desired form prior to heat treatment.

Flint: - Flint is a form of SiO_2 usually produced from sand or rock. It is used in a finely pulverized form as a filler to give clay and final product the desired properties.

Feldspar: - Feldspar is a broad, generic name applied to a group of alkali-aluminosilicate. Potash feldspar ($\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$) and in case of Na ($\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$) is soda feldspar. Most feldspar however are combinations of these two types, it is known as flux in ceramic industry.

Flux plays a key role in the vetrification of clay bodies by reducing the overall melting point.

Vetrification: - It is a transformation of a substance in to glass. It is achieved by heating material until they liquidize.

Manufacturing process: - Following steps are involved

a) Weighing of raw material b) Mixing c) Calcining d) Spray drying e) Pressing f) Binder burn out.

The first step to weigh, dry mix and ball mill the raw materials. The uniform mixture is then subjected to calcining during which the component reacts to form the polycrystalline component. The clcined powder is allowed for spray drying followed by adding binder (polyalkanine carbonate), in order to increase its reactivity and pressing properly. After proper shaping by dry pressing, the binder is burn out by slowly heating at around 700°C . The parts are sintered (Part of firing process) at 1300°C .

Types of ceramic products: - Divided in four sectors

1. Structural, including bricks, pipes, floor and roof tiles
2. Refractory, like kiln lining, gas turbine radiant, steel and glass making crucible.
3. White wares including tableware, wall tile, pottery products and sanitary ware.
4. Technical also known as engineering, which includes tiles, used in space shuttle programme, gas burner nozzles, biomedical implants, jet engine turbine blades and missile nose cones.

Applications of ceramics:-Besides numerous conventional uses of ceramics are also used in...

1. In the manufacture of knives being stay sharp for much longer than of a steel knife although it is more brittle.
2. Ceramic such as alumina and boron carbide have been used in ballistic armored vests to repel large caliber rifle fire.
3. Ceramic ball can be used to replace steel in ball bearing. Ceramic are also more chemically resistant and can be used in wet environment where steel bearing would rust. The main drawback is higher cost.
4. Ceramic are capable to work at very high temp. and do not require a cooling system and allow a major weight reduction and therefore greater fuel efficiency.
5. Ceramics finds prospects in the medical sciences also. bio ceramics such as dental implants and synthetic bone is in the market to be used as bone replacement or synthetic bone.
6. High-tech ceramics are used in watch making for producing watch cases for its light weight, scratch resistance and durability.