

## 4.8 HIGH ALUMINA CERAMICS

High alumina ceramics contains 85% or more by weight of  $\text{Al}_2\text{O}_3$ .

- Alumina is nothing but an aluminium oxide ( $\text{Al}_2\text{O}_3$ ), which is the oldest engineering ceramic.
- Alumina is produced from bauxite ( $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ).

### *Characteristics of alumina:*

1. Aluminas have excellent hardness, wear resistance and chemical inertness properties.
2. They are more stiffer than steels.
3. They are more stronger in compression than many hardened tool steels.
4. They retain 50% of their room temperature strength at elevated temperature (about  $1093^\circ\text{C}$ ).
5. They possess very good environmental resistance.
6. These are mechanically strong, dense materials, unlike refractories which are usually porous.
7. They have ability to resist high temperature because they are poor thermal conductors.
8. They possess low neutron absorption cross-section. This property enables them to find application in nuclear equipment.
9. Alumina is blended with other ceramics such as zirconia to improve its tensile and toughness properties.
10. They have high corrosion resistance.
11. They have high dimensional stability.

## Applications & uses

- (i) Alumina is used as a refractory material for high temperature applications.
- (ii) Alumina makes an excellent high voltage insulator. Classical applications are for insulators in spark plugs and in insulating substrates to support integrated circuits.
- (iii) Alumina based ceramic tools have very high abrasion resistance, hot hardness and are chemically stable than high speed steels. So they are used in cutting cast irons, and steels to obtain good surface finish.
- (iv) Because of its high hardness, it is often used as an abrasive material in grinding wheels.
- (v) It is used for pump liners, pump impellers, check valves and nozzles subjected to erosion.

Some unique applications found in medical use that include restoration of teeth, bone filter and orthopaedic implants