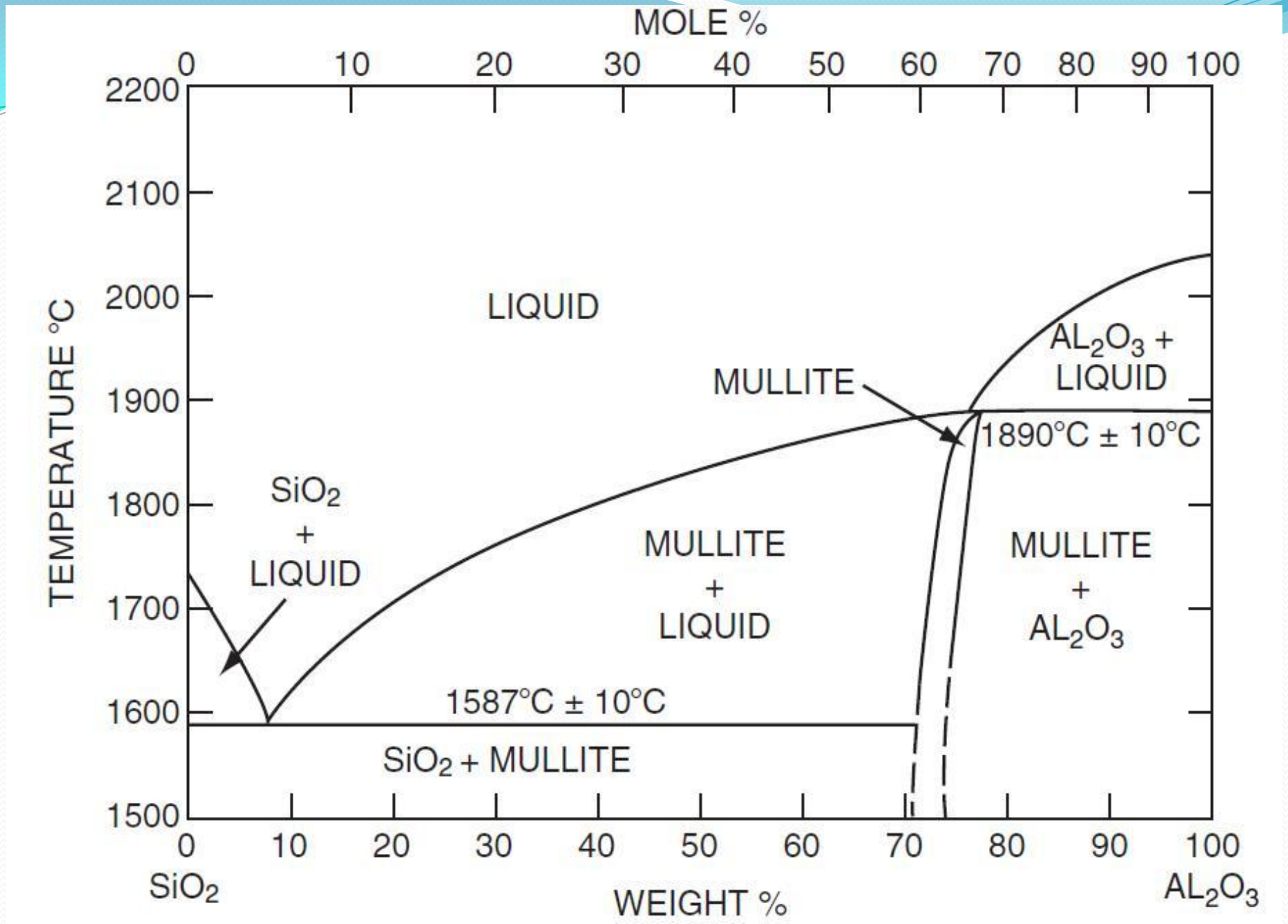
Types of Refractories
2) High Alumina Refractories

- **2) High Alumina Refractories:**
- The term high-alumina brick refers to refractory brick having an alumina (AI_2O_3) content of 50 % or higher.
- Refractories of this group are not used extensively because they are costly. As a general rule the refractoriness increases with increase in the Al_2O_3 content of alumina silicate refractories.

- For alumina-silica brick, **refractoriness** is generally a function of alumina content.
- The refractoriness of 50% alumina brick is greater than fireclay brick and progressively improves as alumina content increases up to 99+%. This relationship is best described by the Al_2O_3-SiO_2 phase diagram.


MOLE %
0
10
20
30
40
50
60
70
80
90
100
2200
2100
2000
1900
1800
1700
1600
1500
TEMPERATURE °C
LIQUID
MULLITE
AL_2O_3 + LIQUID
1890°C ± 10°C
SiO_2 + LIQUID
MULLITE + LIQUID
MULLITE + AL_2O_3
1587°C ± 10°C
SiO_2 + MULLITE
SiO_2
WEIGHT %
AL_2O_3

- **Types of High Alumina Refractories**
- Most high alumina refractories are classified according to their alumina content, which could range from

  50% - 99%.

They are designated as:

50%, 60%, 70%, 80%, 85% and 90% alumina.

- Two classes of high alumina refractories are distinguished by a microstructure that is essentially a single, crystalline phase. These are: **(1) mullite refractories** and **(2) corundum refractories**.

- **(1) Mullite Refractories**
- Mullite ($3Al_3O_3.2SiO_2$) is formed as a reaction product or consequence of heating mixtures of **alumina** and **silica**. The theoretical composition of mullite is:

71.6% Al_2O_3 and **28.4% SiO_2** by weight basis.

- Mullite is a very refractory compound exhibiting a melting point of **1850°C**. As the mullite content of a refractory increases as the composition approaches 72% Al_2O_3, the refractoriness of the material usually increases due to the presence of the mullite.

- Mullite refractories have excellent volume stability and strength at high temperatures. They are highly suitable material for electric furnace roofs, blast furnaces, and the superstructure of glass tank furnaces.

- **(2) Corundum Refractories**
- The **99% alumina** class of refractories is called corundum. These refractories comprise single-phase, polycrystalline, alpha-alumina.

- **High Alumina Refractory Properties**

1. Alumina has a **specific gravity** of 3.96 and silica, in its various forms, ranges in specific gravity from 2.26 to 2.65.
2. It has high refractoriness and fusion point >1850°C.
3. It is chemically stable oxides known.
4. It offers excellent hardness, strength and spalling resistance.
5. High-alumina brick are resistant to acid slags, that is, those high in silica. As Al_2O_3 content increases, slag resistance generally improves.

Method of Manufacture of High Alumina Bricks

Crushing

Calcined Bauxite and clay are crushed to ~25 mm size, separately.

Method: Hammer mills / Machine crushing.

Grinding

The crushed ores are powdered to 200 mesh size separately. Method: Jaw crushers / Ball mills.

Screening

Impurities are removed from raw material by adopting one of the methods depending on the nature of impurity.

Method: Settling / Magnetic separation / Chemical methods.

Mixing

The above raw materials are mixed for proper distribution and made into slurry in order to facilitate moulding.

Moulding

The plastic (i.e. flexible) slurry is poured into moulds to get required shape and size by either:
Hand moulding / Mechanical moulding

Drying

The moisture and volatile matter are removed by heating the moulded brick in tunnel driers heated by steam.

Firing

The dried bricks are fired at 1700 – 1800°C in Tunnels / Shaft / Rotary kiln

- **Uses of High Alumina Refractories**

1. They are used extensively in the electric furnace roofs, piers and muffles for a variety of furnaces.

2. Numerous applications where strength at high temperature is an essential requirement.

3. The aluminium and glass industries use high-alumina refractories to keep the melt in the molten state.


Socket Ratchet
Spark Plug Socket
Socket Extention
EFI/OHC


PERFORMANCE
SPARK
PLUG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