SILICATE CERAMICS

Silicates are materials composed generally of silicon and oxygen.
The following groups of materials relate silicate ceramics:

- ⊡ **Technical Porcelain**
- ⊡ **Magnesium Silicates**
- ⊡ **Mullite Ceramics**
- ⊡ **Properties of some silicate ceramics**

Technical Porcelain

Technical Porcelain generally consists of silica (**SiO_2**) and alumina (**Al_2O_3**). The natural ingredients of these components are quartz, feldspar, soapstone and clay (kaolin).
Depending on the proportion of silica and alumina in material composition two types of porcelain may be prepared: quartz porcelain or alumina porcelain.

Alumina porcelain contains higher amount of more expensive alumina and possesses higher mechanical strength, than silica porcelain.
The following characteristics are typical for Technical Porcelain:

- ⊡ High mechanical strength;
- ⊡ Excellent dielectric properties;
- ⊡ High chemical resistance.

Technical porcelain is generally used in electrical engineering as a good insulator.

Magnesium Silicates

Magnesium Silicates (Steatite and Cordierite) consist of silica (**SiO_2**), magnesia (**MgO**) and some alumina (**Al_2O_3**).
The natural ingredients of Magnesium Silicates are soapstone, clay, corundum, mullite.

The process of steatite ceramic preparation:

- ⊡ Soapstone (talc) as a basic component + at least 10% of clay + fluxes (barium carbonate, BaO, CaO). Some SiO_2 may be added for better firing. Type of the flux determines the electrical properties (work frequency) of the steatite ceramic.
- ⊡ The raw materials are wet milled to fine particles and mixed to form a slurry. The slurry is then either extruded or spraydried to spherical granules and pressed.
- ⊡ The firing temperature is 2460-2480F (1350-1360C). Strict temperature control is important.

The following characteristics are typical for Steatite:

- ⊡ High mechanical strength;
- ⊡ Good dielectric properties;

- ⊡ Very low loss factor;

Steatite is used in heat engineering and in electrical engineering for manufacturing sockets, control housings, insulating beads, low-voltage power fuses and base plates

The following characteristics are typical for Cordierite:

- ⊡ Low coefficient of thermal expansion;
- ⊡ High thermal shock resistance;
- ⊡ Good mechanical strength.

Cordierite is used mostly in heat engineering for manufacturing supports of heating elements, parts of water heaters, pipes of heating element, gas heater inserts, spark protectors and catalyst carriers in automobiles.

Mullite Ceramics

Mullite Ceramics consist of mullite (**$3Al_2O_3*2SiO_2$**), alumina (**Al_2O_3**) and glass (**SiO_2**).
Sintered Mullite Ceramics have porosity up to 10%, which may be considerably reduced by increasing the content of glass phase above 10%.

The following characteristics are typical for Mullite Ceramics:

- ⊡ High strength;
- ⊡ High thermal shock resistance;
- ⊡ Relatively low thermal expansion;
- ⊡ Good creep resistance.

Mullite Ceramics are used for manufacturing high temperature parts, kiln furniture, slide gates, ladles for molten metal, protection tubes for thermocouples, glass industry refractories.

Properties of some silicate ceramics

(Materials Data)

- ⊡ Silicate ceramic Alumina Porcelain C110
- ⊡ Silicate ceramic Steatite C221
- ⊡ Silicate ceramic Cordierite C410
- ⊡ Silica aerogel monolith

Source : http://www.substech.com/dokuwiki/doku.php?id=silicate_ceramics