**Ceramic powder preparation**

The processing of raw ceramics into ceramic products requires the preparation of ceramic powders.

The raw materials for powder preparation are generally natural minerals such as Quartz, Zircon, fireclay. The raw materials need to be processed in order to convert them into the desired products with special characteristics. The type and nature of processing may be different for different products and applications. Most shaping processes for ceramics require the starting material to be a plastic paste – This paste is comprised of fine ceramic powders mixed with water

**Characteristics of powders**

Every raw material should possess some desirable characteristics for further processing. Some of the important characteristics of powders which define the quality of the final ceramic product should be kept in mind. Desirable characteristics depend upon the quality of product and

application.

These characteristics are:

 Chemical composition

 Phase composition

 Particle size

 Particle size distribution

 Particle shape

 Agglomeration

**Ceramic powder processing**

Ceramic powder processing can be broadly divided into two categories. One is chemical processing of powders using the products of chemical reaction which are in the form of powders.

Second processing technique is mechanical preparation methods in which a direct contact of particles takes place with some agents entails reducing the particle size of the raw material by crushing, grinding, and milling or fine grinding. So in coarse range is known as “crushing” and in fine range it is called “grinding”.

**Mechanical preparation method**

**Crushing/Grinding/ Milling**

Mechanical preparation method involves crushing, milling in a ball mill or grinding ceramic raw materials into small particles. A ball mill is a machine with a rotating hollow cylinder partly filled with steel or white cast iron balls. Depending on the powder amount and the powder

properties, different types of mills are used for dry and wet grinding.

The primary crusher in ore processing is usually a gyratory or jaw type, which in large operations is capable of accepting rocks up to 2 m in diameter.

♣ Reducing particle size in ceramics processing by using mechanical energy in various forms such as impact, compression, and attrition

. ♣ combination techniques are most effective on brittle materials such as cement and metallic ores.

Crushing in general is an energy intensive process. Primary crushing in particular consumes large amounts of energy due to the significant amount of size reduction taking place. In addition to the amount of size reduction, the energy required for breakage in crushing applications is dependent upon the physical properties of the material and the quantity of material being crushed. The rate of energy input is dependent upon the type of crushing machine used since the application of the crushing force changes with machine type. Primary crushers apply breakage forces by means of compression or impact. Jaw and gyratory crushers are the most common types of primary compression crushers. Each applies a compressive force to rock particles as they come in contact with the crushing surfaces. The force is applied slowly (in comparison to impact machines) resulting in abrasion and cleavage fracture. Impact crushers apply a high-speed impact force to rock particles using hammers or blow bars. The rate of energy input is much higher causing particles to shatter. Impact crushers can achieve higher reduction ratios than jaws and gyratory’s but are limited by high rates of abrasive wear and thus are restricted to somewhat softer rocks.

♣ The crushing forces have to be intense so that the elastic limit of the material being crushed is exceeded. Crushers tend to be massive and rugged (although sometimes portable), requiring large drive motors.

♣ They are energy intensive and expensive, both to construct and to operate. The rock is crushed to a maximum size of about 0.20 to 0.25 m in diameter at this stage. From this point, the ore passes on to a second or a third stage of crushing in either gyratory, cone, or roll crushers. Intermediate screening occurs at each stage to separate out the larger rock chunks for further crushing.

♣ Final product of the ore crushing plant is usually all 10 to 20 mm in diameter (i.e., particles of this size will pass through a screen with these openings), with a high percentage of the product finer than this. This product then passes on to the ore grinding operation.

♣ The gyratory, jaw, cone, and roll crushers crush rock by applying high compressive forces to each rock. Another type of crusher accomplishes similar results using impact hammers or blow bars mounted on a rotor, thereby producing high kinetic energy impacts on each rock at velocities of around 30 m/s.

♣ These impact crushers are capable of producing a high ratio of size reduction in one stage of crushing. However, due to the high velocities of the hammer, the wear rate is very high. Impact hammers are, therefore, typically used to crush softer ores such as coal, limestone, and cement plant feed.

**Some of the important parameters are given below:**

♣ type of the raw material

♣ amount of the raw material

♣ maximum individual size of the feed materials

♣ target raw material size

♣ method of the feeding

♣ reguired capasity of the plant