

## Lecture 5 Processing of Ceramic Parts - Pressing

A wide variety of fabrication processes are used to prepare ceramics powder for ceramic product. The process for a particular product is based on the material, shape complexity of the product, property requirements and cost. Processing of ceramics generally involves three basic steps:

- Ceramic Powder Preparation (crushing/milling/grinding)
- Mixing powder particles with additives (to impart special characteristics)
- Shaping, drying and firing the material

Ceramic fabrication processes can be divided into six common categories as shown in figure 1.

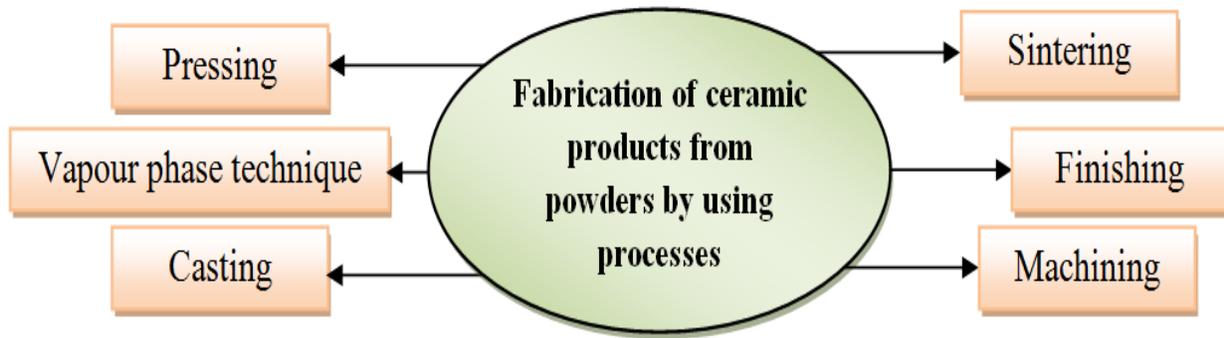


Figure 1 Various processes used in fabricated ceramic products

### **Pressing**

Pressing is one of the simplest methods of ceramic powder processing for development of ceramic based products. Raw material is crushed in fine powders which is mixed with additives and then processed into useful products. In pressing operation, powder containing little amount of water is compacted under pressure. A wide range of traditional and advanced ceramic based products are processed by powder pressing method which includes electronic and electrical ceramic items, floor and wall tiles and insulator of spark plug. Powder pressing can be carried out in number of ways which are as follows (figure 2):

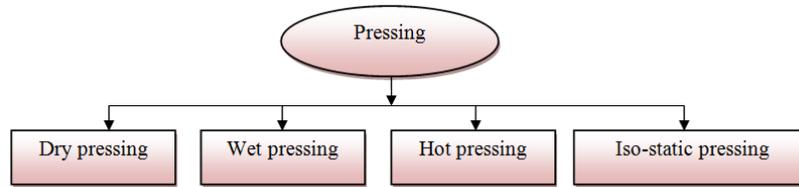


Figure 2 Powder pressing techniques

### Dry pressing

Dry pressing technique is used for simple shapes such as abrasive products and whitewares. The schematic of dry pressing technique is shown in figure 3. Water content in the powder mixture is very low (less than 4%). Various binders (organic as well as inorganic) may be added in the mixture depending on the requirement. Production rate is high in dry pressing method and close dimensional tolerances are achieved. The advantages associated with dry pressing technique are maximum production rate and better tolerance control. The disadvantages of this process include non-uniformity in density and wear resistance of dies.

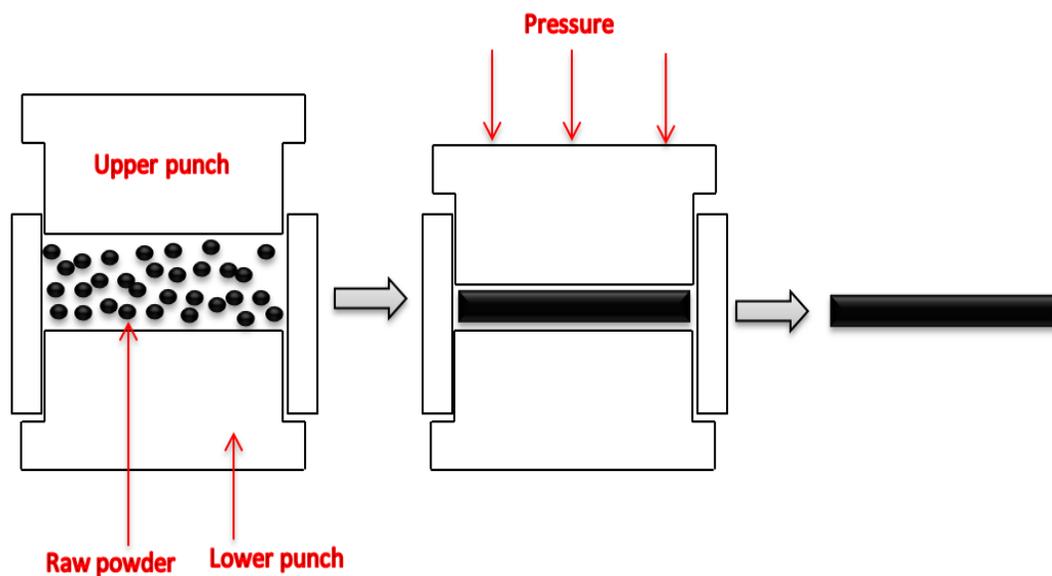


Figure 3 Dry pressing technique

### Wet and hot pressing

In wet pressing method, product is processed under high pressure in a mold. Moisture content is relatively high (10-15%). In wet pressing technique, production rate is high and it is possible to handle intricate shapes but the process is suitable for smaller jobs and there is not better control over dimensional accuracy.

In hot pressing method, both pressure and temperature are applied which reduce the void content of the part and produces a denser and stronger product. The advantage of hot pressing technique is that strong and dense parts can be comfortably processed. The demerits of this process are the requirement of controlled atmosphere and shorter life of dies.

### **Iso-static pressing**

Iso-static pressing is used to obtain uniform density in the product. Insulators of spark plug are fabricated by iso-static pressing method. Powder mixture is placed around a central mandrel pin in a flexible mold on which fluid pressure is applied from outside. The schematic of iso-static pressing is shown in figure 4. There is uniform density distribution in parts process with iso-static pressing but this process requires high infrastructural cost.

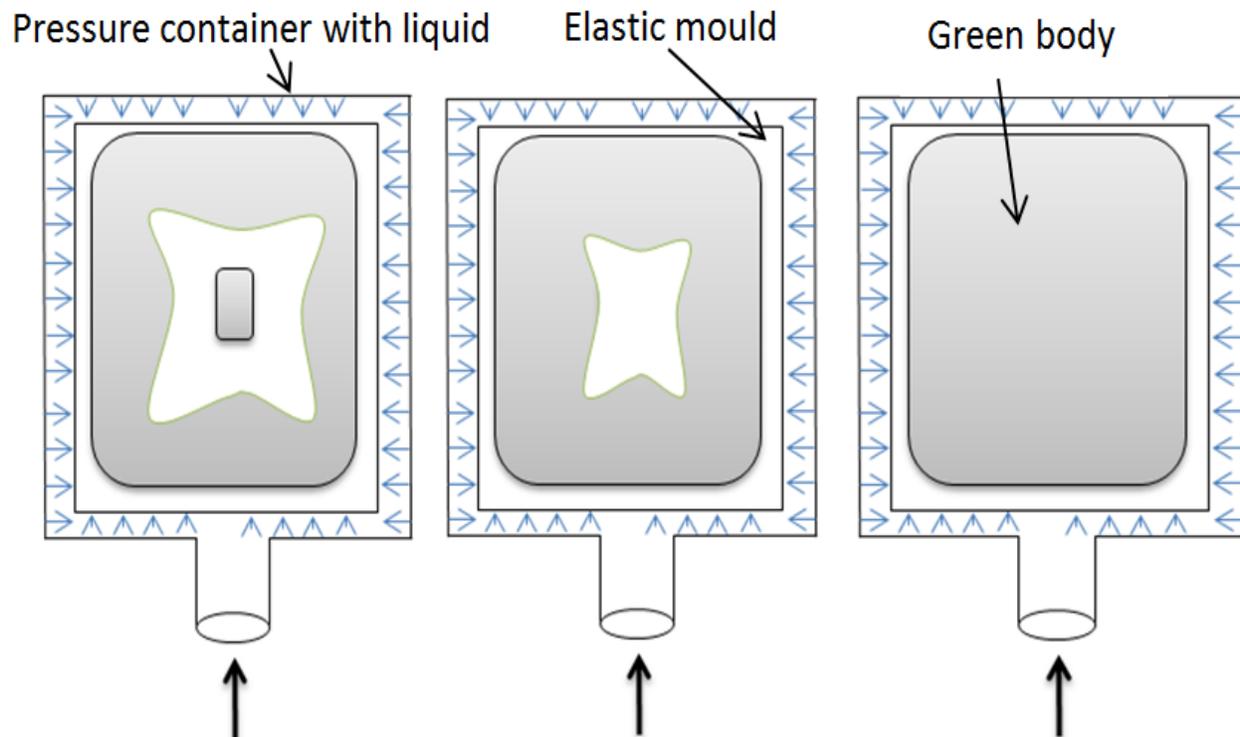


Figure 4 Iso-static pressing technique