

Question

Differentiate between ceramics and nanoceramics materials?

(05)

Ceramic

Ceramic materials

Nanoceramic materials

Definition

- a ceramic is an inorganic non-metallic solid made up of clay that have been shaped and then hardened by heating to high temperature.

- Nanoceramics are like super tiny, super special ceramics. Imagine making ceramics like pots or tiles but really small like too small to see with your eyes. These are super tiny ceramics are super strong work well in tiny electronic gadgets and even help in medicine.

Date: ___/___/20___

Examples

- Tile
- Bricks
- Pottery
- Porcelain
- Nanoparticles (silica, zinc oxide)

Properties

- | | |
|--|--|
| <p>i) Considerable stiffness</p> <p>They are stiff under compression and bending</p> | <p>i) Increased surface area</p> <p>which boosts reactivity and allows for tailored structures</p> |
| <p>ii) Corrosion/oxidation resistant</p> | <p>This leads to improved mechanical strength, thermal and electrical conductivity</p> |
| <p>iii) Brittle, having little elasticity</p> | <p>ii) Reduced grain boundaries</p> <p>Enhance performance, crucial in applications like cutting tools and electronics.</p> |
| <p>iv) Thermal and electrical insulator but certain ceramics conduct electricity.</p> | |

v) wear-resistant and durable, therefore are used in industry

iii) **Biomedicine**
In Biomedicine, nanoceramics offer superior biocompatibility, ideal for implants and drug delivery.

Applications

1) **Aerospace**

It is used in the formation of parts of space shuttle, rockets and space stations

2) **Consumer usage**

It has great use in homes like

glassware, pottery etc

3) **Automotive Industry**

It is used in catalytic converters, filters, plugs, thermostats etc

1) **Armor**

Nanoceramics can be used in body armor to absorb k.E from blunt trauma and high velocity ammunition.

2) **Bone tissue**

engineering

It helps to

Date: ___/___/0___

4) **Medical (Bioceramics)**

Ceramics are used in medical field especially in dental and bone fixings and in bone implants.

to support bone regrowth and repair.

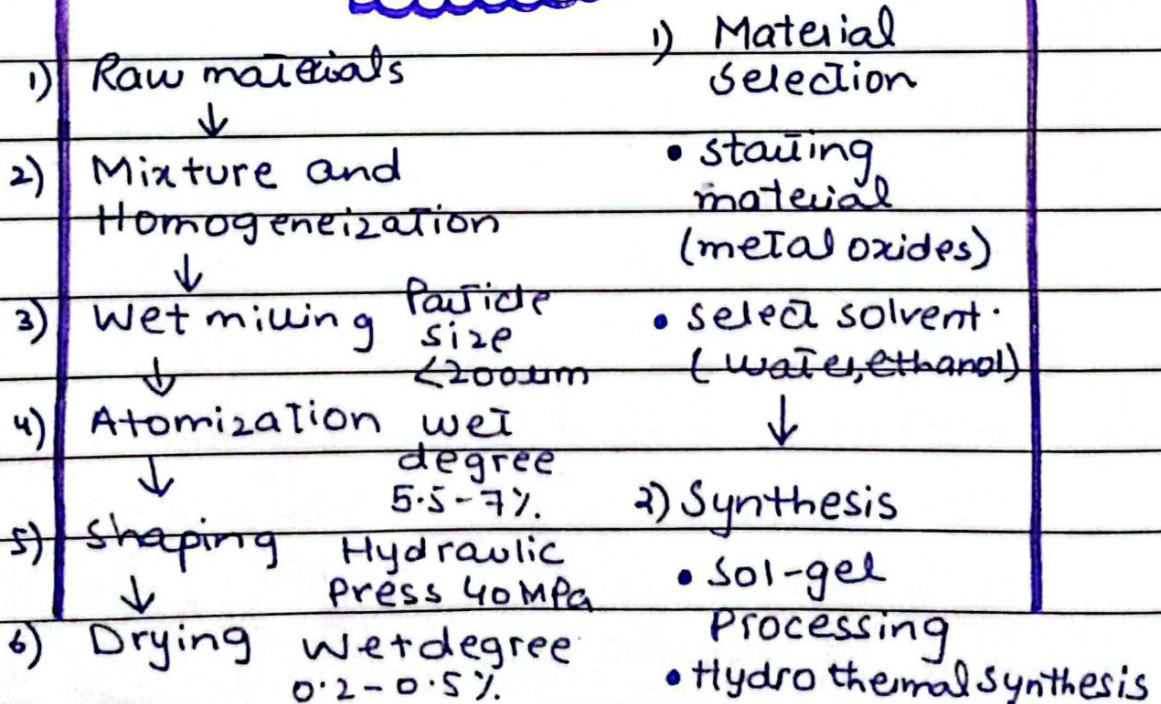
5) **Buildings and construction**

Manufacturers use ceramics to make bricks, tiles, piping and other construction materials.

3) **Electronics**

Nanoceramics can be used as insulators, semiconductors, conductors and magnets.

Production



- ↓
- 7) glazing layer
↓
thickness 75-300um
- 8) Fast firing 40-50min
↓
- 9) Ceramic Tile
- 3) Powder processing
- Draw the gel or powder
 - crush and grind into a fine powder
 - sieve to remove agglomerates
- ↓
- 4) Compaction
- Uniaxial pressing
 - Isostatic pressing
- ↓
- 5) Sintering
- Heat the compacted powder
 - Hold for a time
 - Cool slowly
- 6) Characterization
- Measure grain size and distribution
 - Determine surface area
 - Test strength and hardness
- 7) Final processing
- machining or grinding to desired shape
 - surface treatment (coating, polish)