ENGG*2120 Fall 2011

Chapter 13 Assignment with Answers

1. Write down the basic category of ceramics

Answer:

- glasses
- clay products
- refractories,
- cements
- advanced ceramics

2. Write down few advantages and disadvantages of advanced ceramics being used in a heat engine.

Answer:

- Advantages:
  - Run at higher temperature
  - Excellent wear & corrosion resistance
  - Low frictional losses
  - Ability to operate without a cooling system
  - Low density

- Disadvantages:
  - Brittle
  - Too easy to have voids- weaken the engine
  - Difficult to machine

3. Why advanced ceramics are chosen for electronic packaging?

Answer:
Advanced ceramics are chosen as they can securely hold microelectronics & provide efficient heat transfer

4. Write down two criteria for the electronic packaging of advanced ceramics?

Answer:
Good heat transfer coefficient and poor electrical conductivity

5. List the materials currently being used for electronic packaging

Answer:

- Boron nitride (BN)
- Silicon Carbide (SiC)
- Aluminium nitride (AlN)

6. Cite an example for oxygen sensors and explain its working principle

Answer:

Example: ZrO_2

- Principle: Make diffusion of ions fast for rapid response.

- Approach:
  Add Ca impurity to ZrO_2:
  -- increases O^{2-} vacancies
  -- increases O^{2-} diffusion rate

- Operation:
  -- Voltage difference produced when O^{2-} ions diffuse from the external surface of the sensor to the reference gas.

7. State the significance of ceramic armor and give an example

Answer:

They are extremely hard materials which can shatter the incoming projectile and serve as energy absorbent material underneath.
Examples: Al_2O_3, B_4C, SiC

8. State true or false
'Ceramic materials are wear resistant'

Answer:
True

9. Ceramic abrasives are used for _____& _____

Answer:

Sandpaper, cutting and polishing

10. List the areas where ceramic glasses and cements are used.

Answer:

Glasses: optical, composite reinforcement, containers and household applications
Cement: composites and structural applications.