Compiled by
Dr. Arbind Prasad
Assistant Professor(Mech. Engg.)
Katihar Engineering College,Katihar
Bihar, India-854109

ENGINEERING MATERIALS AND THEIR PROPERTIES

(2 Marks)

Q.1 What is materials?

Ans: Material is something that out of which anything can or can be made from it. It consists of matter.

Q.2 Give two example of ferrous and non-ferrous metals?

- Example of ferrous metal-cast iron, steel
- Examples of non-ferrous metal-Zinc, Copper.

Q.3 Give two example of non-ferrous metal?

Ans: copper and Zinc.

Q.4 State the application of ceramic?

Ans:-Ceramic material can be used as sand, glass, bricks, cement.

Ceramic material are corrosion resistance and be used as concrete, insulator, abrasives, refractories and plaster.

Q.5Give four important characteristics of ceramics?

Ans: 1.Brittleness

2.Resistance to high temperature.

3.Hardness

4.It is insulator.

Q.6. Classify composite material?

Ans:-The materials which are produced by combining of two dissimilar materials in to new materials that may be better suited for a particular application then the original material is called composite.

The base materials which is present in large amount is called matrix. The other material is sometimes known as reinforcing phase.

5 MARKS

Q.1 Classify material?

Ans: Most engineering material can be classified as follows

(a)metals

*ferrous

*non ferrous

(b)Ceramics

(c)Organics

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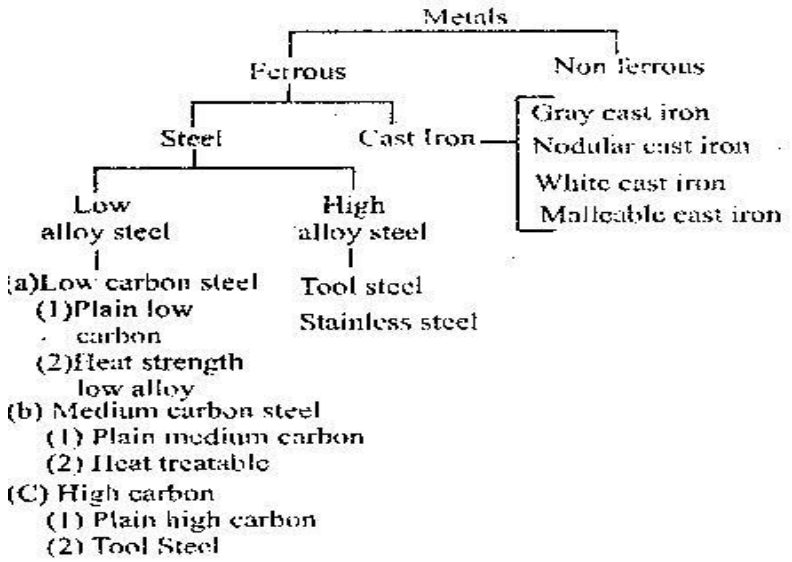
(d) Composites

(e) Semiconductors



7 MARKS QUESTIONS AND ANSWERS.

Q.1.What are the various factor affecting the selection of materials?

Ans: The wide varieties of material exhibiting diversified properties are available and necessary to use materials having properties suitable for the application .and selection a suitable material among the materials available is a very complex process, involving risk factor and therefore several factors has to be taken in to account. The factor affection the selection of materials for engineering purpose are the following.

(A)Properties of material:

The most important factor affecting the selection of materials in relation to their intended for use.

The properties of material define specific characteristics of material and form a basis for predicting behavior of the material under different condition.

The important properties of materials are

- Mechanical(stress),
- thermal (heat/cold),
- Chemical (atmosphere, water, chemicals),
- Electrical (power, current),
- Magnetic

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- Radiation (light, ultraviolet)

(B) Performance requirement:

* The material of which a part is composed must be capable of performance the function without failure

* While it is not always possible to assign quantitative values to these function requirements they must be related as precisely as possible to specified value of required properties.

(C) Reliability of material:

A material in a given application must also be reliable, simply stated reliability is the degree of probability that a product and the material of which it is will remain stable enough to function in service for the intended life of the product without failure. A material if it corrodes under certain conditions, then it is neither stable non reliable for those conditions.

(D)Safety

A material must perform its function otherwise the failure of the product made out of it may be catastrophic as in air plane turbines, high pressure system. The materials that give of spark when struck are hazardous for use in coal mines.

(E) Physical attributes

The physical attributes such as configuration, size, weight and appearance sometime serve functional requirement for ex. the functioning of a gyroscope or a fly wheel is directly related to the weight of material used.

(F)Environmental conditions

The environment in which a product operates strongly influence the service performance. humidity, water, chemicals can cause corrosion and subsequent failure of materials.

(G) Availability

Obliviously a material must be readily available and available in large quantity for the intended application .in time of material scarcity this constraint becomes significant. In future with the projected scarcity of many material resources important.

(H) Disposability and recyclability

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These are the newest of constraints and increasingly important factors in the material selection. This factor assumes very important in disposability and recyclability of nuclear fuels/material and plastic.

Cost perhaps more often than any other constraints are the controlling factor in a given material application problem. For in every application there is cost beyond which one can be not go that prescribes the limit that can be paid for a material to meet the application requirement. It is becoming apparent that this limit will be exceeded the design will be changed to alter material requirement. this fact of limiting cist is as true in aerospace field as in consumer products fields. The only different is that the limiting cist in aerospace system is considerably higher than for consume products.

The total original cost if material for a given application is made up of two components the cost of material and the cost of processing the material in to finished product part of product.

Material selection: One of the most important requisites for the development and manufacture of satisfactory product at minimum cost is to make a sound economic choice of materials.

The selection process:

The material selection process involves the following major operation. The Analysis of material application problem this requires the study of the material performance requirements, including functional performance physical attributes and application conditions.

The translation of material application requirements material property values. in some cases, this is relatively easy as in part where unidirectional stresses are involved. Here mechanical strength properties, such as yield and compressive strength can directly have derived from the measured applied loads encountered in the application.

Selection of candidate materials once the required properties are clearly specified the rest of the selection process involves the search for the material that best meets those properties.

In choosing candidate material any one or more of a number of criteria can be used. past experience and materials being currently used are often guides to the starting points. Another method is to base the selection on the most important and critical requirement, different approaches to the solution of materials problem as distinct from simply choosing candidate's material for evaluation should be considered.

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Evaluation of candidate material, the objective of evaluation step is to weight the candidate material against the specified propertied to find one best suited for application .in principle this step is a continuation of previous one in that it is essentially an elimination or screening operation.

Q.2 Classify ceramics?

Ans:- The ceramic material may be divided in to three classes

- Clay product
- Refractories
- Glasses

Ceramics material also are classified in the following ways

- ❖ Functional classification of ceramics.
- ❖ Structural classification of ceramics.

(a) Functional classification:

Group	**Example**
1.Abrasives	Alumina, Carborandum.
2.Pure oxide ceramics	MgO, Al_2O_3,SiO_2
3. Fire clay product	Bricks, Tiles, Porcelain.
4. Inorganic glass	Window glass, lead glass etc.
5.Cementing material	Portland cement, lime etc.
6. Rock	Granites, sandstones etc.
7. Mineral	Quartz, calcite etc.
8. Refractories	Silica brick, Magnetite etc.

(b) Structural classification.

Group	**Examples**
1.Crystallineceramics	Single phase like Mg O or multiphase from MgO to Al_2O_3 system.
2.Non crystalline ceramics	Natural and synthetic inorganic gears (i.e. window glass)
3.Glass bonded ceramics	fire clay products
4.Cement crystalline	