

1.3 SELECTION OF MATERIAL

One of the most challenging task of materials engineer is the proper selection of the material for a particular job, e.g., a particular component of a machine or structure. An engineer must be in a position to choose the optimum combination of properties in a material at the lowest possible cost without compromising the quality.

Factors affecting selection of materials

Performance

This characteristic refers to those properties that are required for the product to satisfy its functional requirements. Materials typically perform one or more functions in a product such as carrying loads, providing heat conduction or thermal insulation, providing electrical conduction or insulation, or containing fluids.

Mechanical properties

The material must possess a certain strength and stiffness. Selected materials are examined for strength and stiffness values, and then potential materials are further inspected for other desired properties.

Wear of materials

Wear is a problem when the materials are contacting each other in product. So it must be ensured that the selected materials have wear resistance. Corrosion is an important engineering design criterion for designs open to the environment for a longer period of time. Some materials are very likely to be corroded in the service depending on the service environment. Metals like iron are heavily prone to corrosion if not prepared to resist corrosion. Painting or any other surface coating method, cathodic protection, etc. are possible ways to minimize the effect and increase the service life.

Costs

Cost is a critical factor to consider when selecting materials for a certain design for most products because they are facing a severe competition in the market. The cost factor can be neglected when performance is given the top priority. When estimating costs, all the associated cost factors must be considered to get a more reasonable value. It may involve the transportation, processing costs, etc.

Reliability and Environmental Resistance

This characteristic relates to the durability of a material, which is its ability to resist deterioration in the environment in which it will be used. It includes such properties as fatigue resistance and resistance to radiation, chemical solvents, and corrosive agents.

Critical characteristics that are needed to satisfy the functional requirements and their constraints, manufacturing process, since the manufacturing process will affect the performance properties of the material. Furthermore, the selection of the manufacturing process will depend on certain properties of the materials. Material properties that can dictate the choice of a manufacturing process include ductility, toughness, form ability, and castability. In addition, one must take into account the geometric attributes of the production.

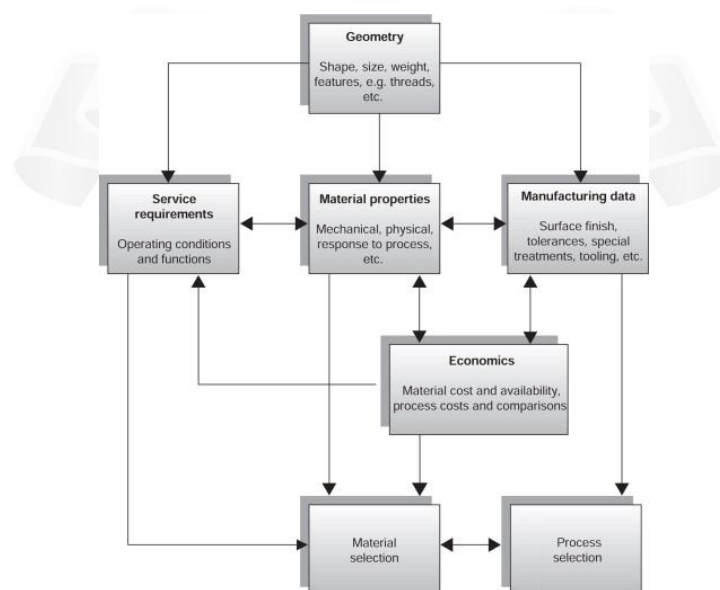
Procedure for materials selection:

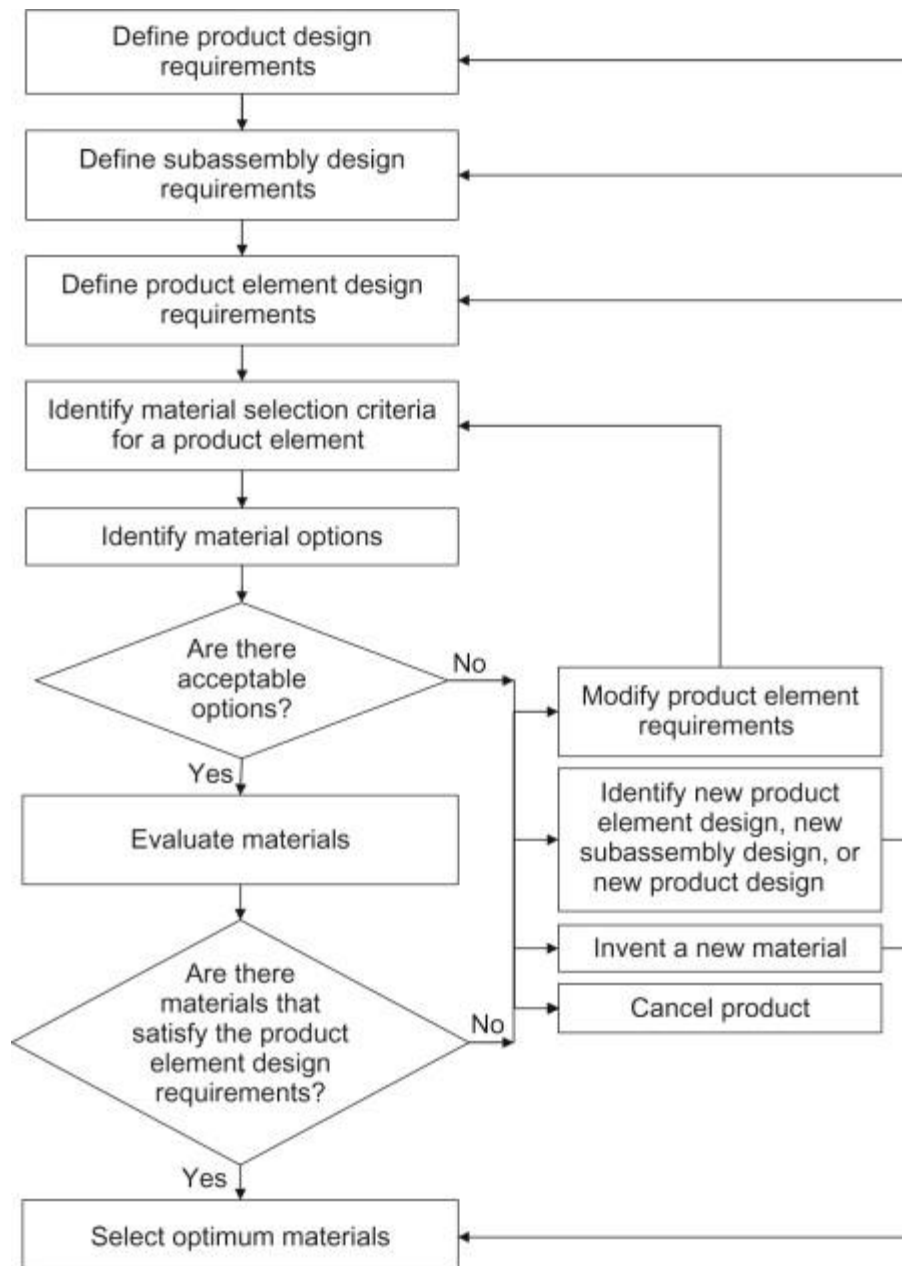
The selection of an appropriate material and its subsequent conversion into a useful product with desired shape and properties can be a rather complex process. Nearly every engineered item goes through a sequence of activities that includes:

design → material selection → process selection → production → evaluation → and possible redesign or modification

- Identify product design requirements.
- Identify product element design requirements.
- Identify potential materials.
- Evaluate materials.
- Determine whether any of the materials meet the selection criteria.

Steps to be considered for selection of materials





Step 1: Identify the design requirements.

Each step involves a synthesis process in which all of the various concerns and requirements are considered together. Compromises, between conflicting requirements are usually necessary and continual effort.

The design requirements include the following items Performance requirements

- ✓ Simplicity and practicability
- ✓ Reliability requirements
- ✓ Size, shape, and mass requirements

- ✓ Cost requirements

Step 2: Identify materials selection criteria

The materials selection criteria are specific materials properties derive from the requirements identified during pervious step.

Step 3: Evaluate candidate materials

There may be candidate materials for which there insufficient date available to indicate whether the materials satisfy certain selection criteria.

Step 4: Select materials to fabricate a component or form a joint between components. they do meet the selection criteria by creating a prototype. Select the materials that satisfy all the materials selection criteria at the lowest cost. Remember, cost includes the cost of the material and the cost

Step 5: Failure Analysis

The selection of materials is finalized with help of failure analysis mode.

Step 6: Service Experience

Design changes may also be made as a result of experience with a limited production run of a new product. Purchasers of the product may also use it in a way not anticipated by the designer, resulting in failure. The design process often continues even after a product is established and widely distributed.

