Manufacturing Process SMJP 2113

Manufacturing in Competitive Environment

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Cellular Manufacturing

Flexible Manufacturing Cells (FMCs)

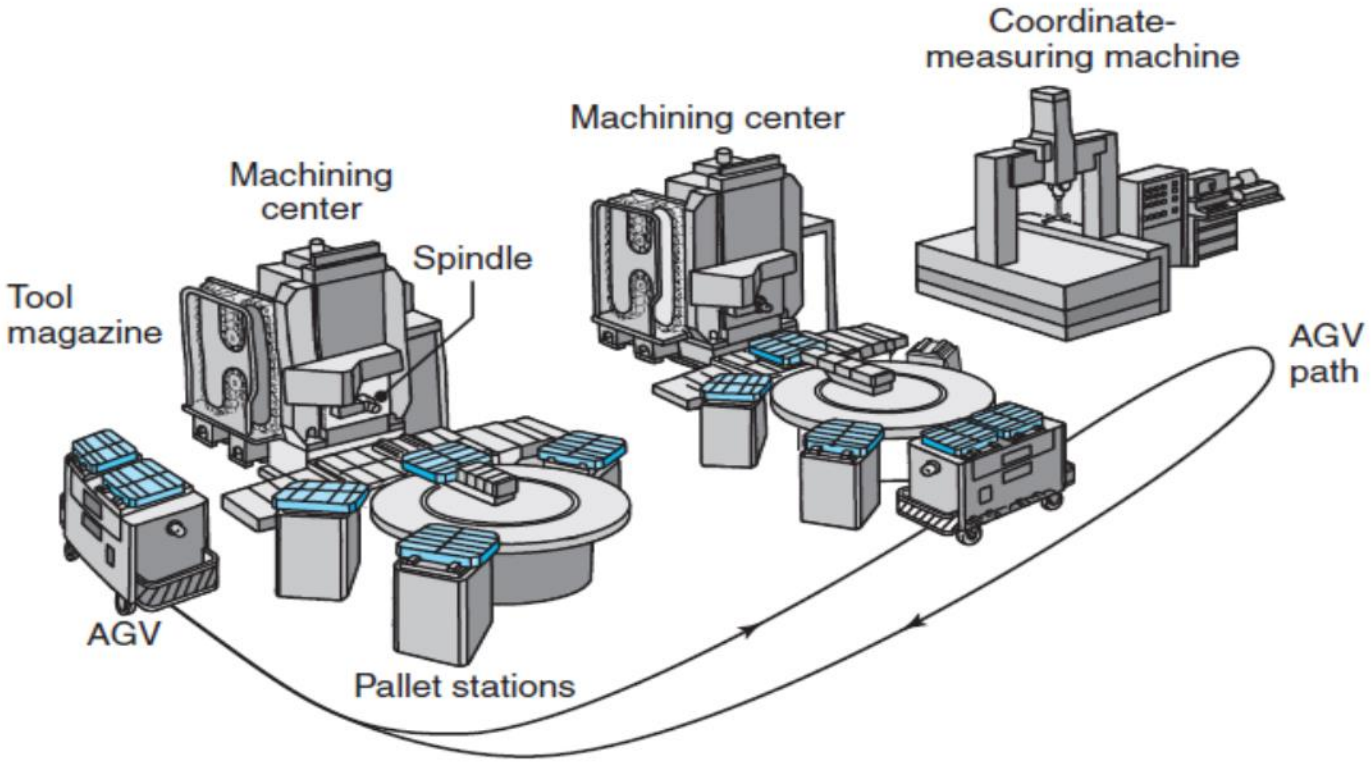
Manufacturing cells can be made flexible by

1. CNC machines
2. Machining centers
3. Industrial robots
4. Mechanized systems for handling materials and parts

- FMCs can be *unattended* or *unmanned*
- Cost of FMCs is very high, have increased productivity, flexibility and controllability

Flexible Manufacturing Systems

A *flexible manufacturing system* (FMS) integrates all of the major elements of production into a highly automated system



Just-in-time Production

The *just-in-time* (JIT) *production* has the following goals:

1. Receive supplies just in time to be used
2. Produce parts just in time to be made into subassemblies
3. Produce subassemblies just in time to be assembled into finished products
4. Produce and deliver finished products just in time to be sold

Just-in-time Production

Advantages of JIT

Advantages of just-in-time:

1. Low inventory carrying costs
2. Fast detection of defects
3. Reduced inspection and reworking of parts
4. High-quality products made at low cost

Just-in-time Production

Kanban

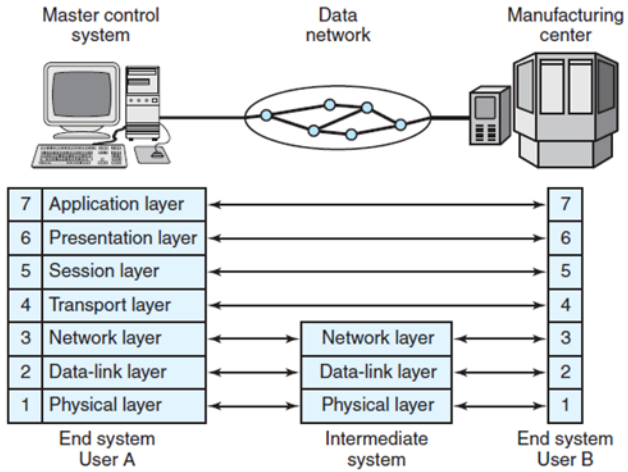
- *Kanban* means “visible record”
- Record consisted of two types of cards:

1. *Production card*
2. *Conveyance card* or *move card*

Communications Networks in Manufacturing

Communications Standards

- Each cell's computers have their own specifications and proprietary standards
- **Manufacturing automation protocol** (MAP) was standardised
- The International Organization for Standardization (ISO)/Open System Interconnect (OSI) reference model is accepted worldwide



Product Design Considerations

Designers must check and verify the following considerations:

1. Alternative designs
2. Design be simplified
3. Smaller and lighter
4. Features eliminated or combined
5. Specified dimensional tolerances and surface finish
6. Time consumed to assemble
7. Use of fasteners minimized
8. Environmental considerations
9. Design activities to be outsourced

Product Quality and Life Expectancy

- Product quality and the techniques involved in quality assurance and control
- High-quality product is considered when it:
  1. Satisfies the needs and expectations
  2. Has a pleasing appearance and handles well
  3. Has a high reliability and functions safely
  4. Is compatible and responsive
  5. Performs improvements easily

Material Selection for Products

General Properties of Materials

- *Mechanical properties:* strength, toughness, ductility, stiffness, hardness, and resistance to fatigue, creep and impact
- *Physical properties:* density, melting point, specific heat, thermal and electrical conductivity, thermal expansion and magnetic properties
- *Chemical properties:* susceptibility to oxidation, corrosion and surface-treatment processes

Material Selection for Products

Manufacturing Characteristics of Materials

- Manufacturing characteristics of materials: castability, workability, formability, machinability, weldability and hardenability by heat treatment
- Quality of the raw material can greatly influence its manufacturing properties

Reliability of Material Supplies

- Factors that influence the reliability of material supplies: shortages, strikes, geopolitical factors, and the reluctance of suppliers to produce materials in a particular shape or quality

Material Selection for Products

Recycling Considerations

Guidelines to facilitate the process during the life cycle of a product are:

1. Reduce the number of parts and types of materials in products
2. Reduce the variety of product models
3. Use a modular design to facilitate disassembly
4. Use single types of polymers
5. Mark plastic parts for ease of identification
6. Avoid using coatings, paints, and plating
7. Avoid using adhesives, rivets, and other permanent joining methods

Material Selection for Products

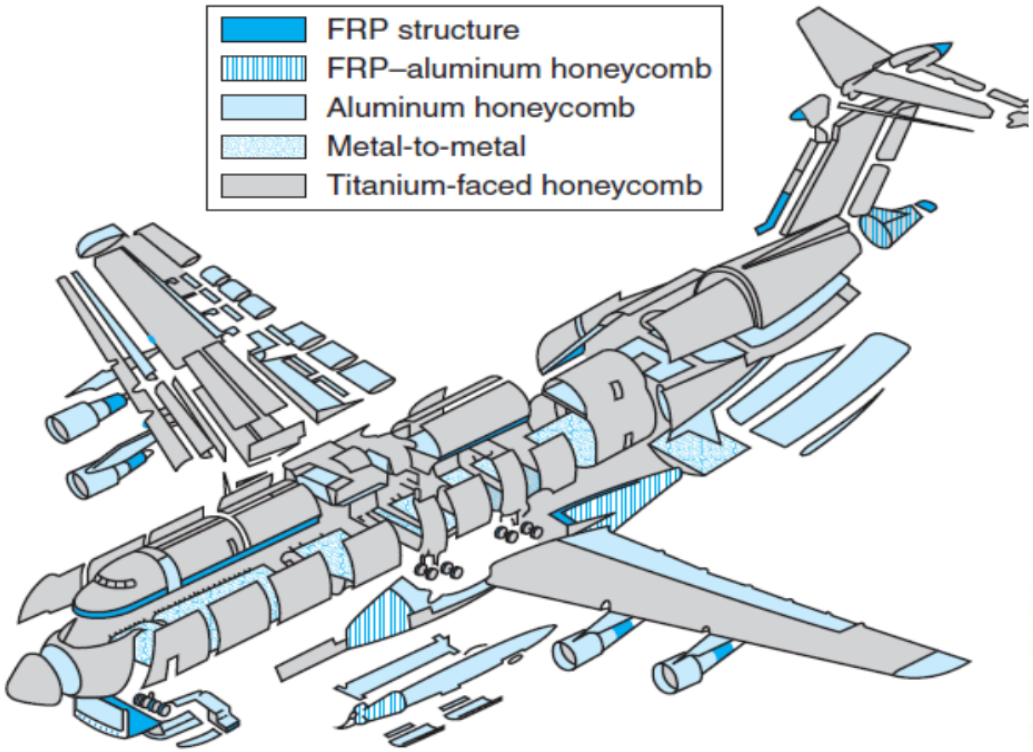
Recycling Cost of Materials and Processing

- Unit cost of a raw material depends only on the material and its shape, size and condition
- Powder metals are more expensive than bulk metals
- Cost of materials decreases as the quantity purchased increases
- Cost of a material is subject to fluctuations caused by supply and demand or complexity

Material Substitution

Substitution of Materials in the Aircraft and Aerospace Industries

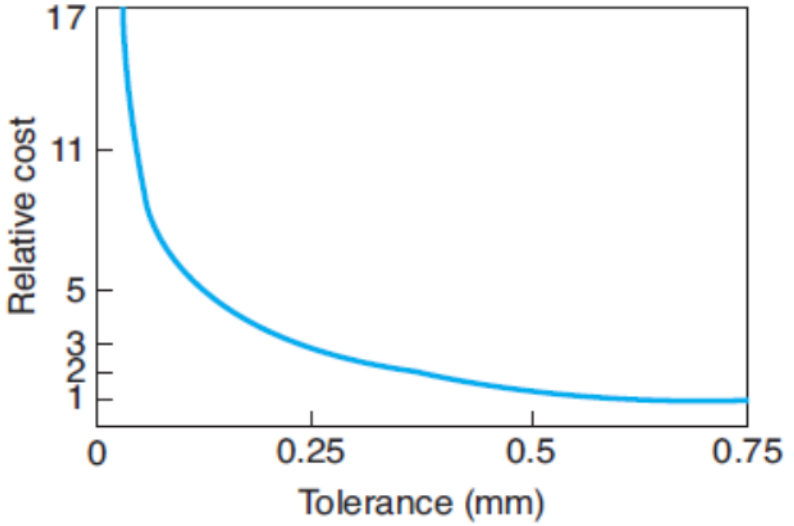
Advanced materials are used in the Lockheed C-5A transport aircraft

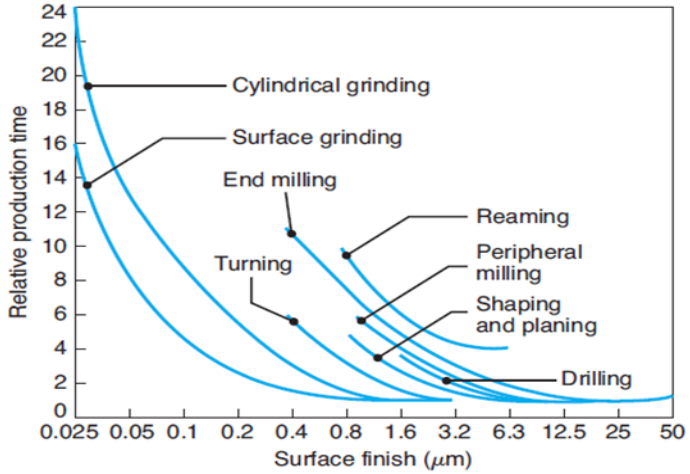


Manufacturing Process Capabilities

Dimensional Tolerances and Surface Finish

- The dimensional tolerances and surface finish produced are important in assembly operations and proper operation of machines and instruments
- Closer tolerances and better surface finish can be achieved by additional finishing operations but higher cost





Manufacturing Process Capabilities

Production Rate

- Production rate is defined as the number of pieces to be produced per unit of time
- Production rate can be increased by using multiple equipment and highly automated machines

Lead Time

- Defined as the length of time between the receipt of an order for a product and its delivery time

Manufacturing Costs and Cost Reduction

- The total cost of a product consists of material costs, tooling costs, fixed costs, variable costs, direct-labor costs, and indirect-labor costs
- Depending on the particular company and the type of products made, different methods of cost accounting may be used
- *Costing systems* are also called *cost justification*
- Costs are also attributed directly to *product liability*

Manufacturing Costs and Cost Reduction

Direct-labour Costs

- Costs for labour that is directly involved in manufacturing products
- Time required for producing a part depends on its size, shape, dimensional accuracy and surface finish
- Labour costs in manufacturing and assembly vary greatly from country to country
- Manufacturers consider moving production to countries with a lower labor rate known as **outsourcing**

THANK YOU