Class 11a:

Materials and Manufacturing Team Project Assignment

11a.1 Engineering Materials

11a.2 Manufacturing Processes

11a.3 Materials and Manufacturing Team Project Assignment

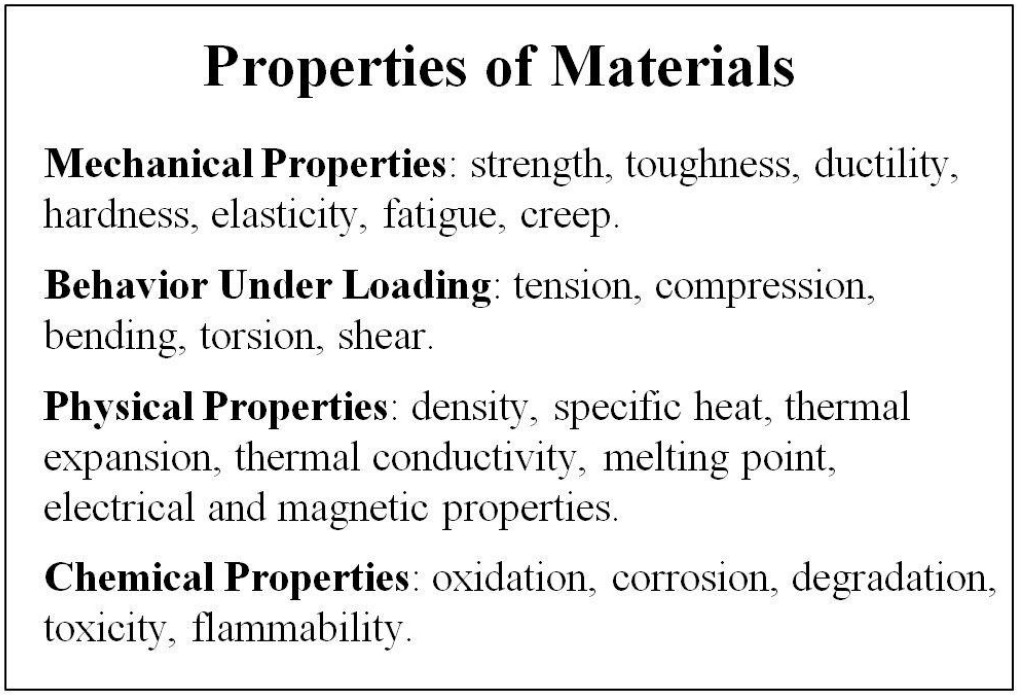


Figure 11a.1 An important aspect to engineering design is the selection of materials used to build the parts. Engineering materials have a wide range of properties. Some of the considerations are strength, density, conductivity, corrosion, and response under loading.

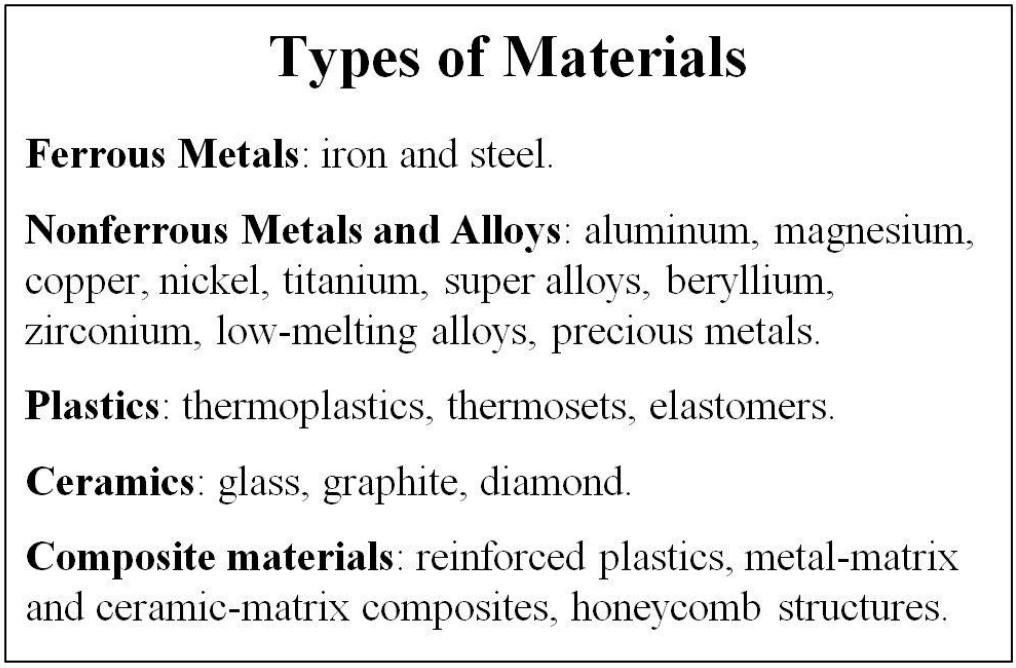


Figure 11a.2 Materials commonly used in engineering design are metals (both ferrous and non-ferrous), plastics, and ceramics. Newer composite materials offer promise, but are still in the research phase.

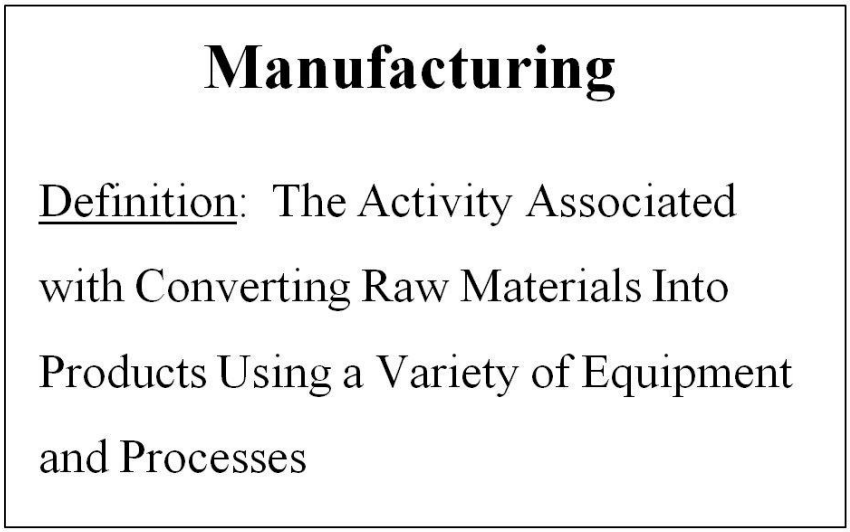


Figure 11a.3 Manufacturing is the activity associated with the conversion of raw materials in products. Many types of equipment and processes can be encountered in manufacturing. It is the next step after the product has been designed.

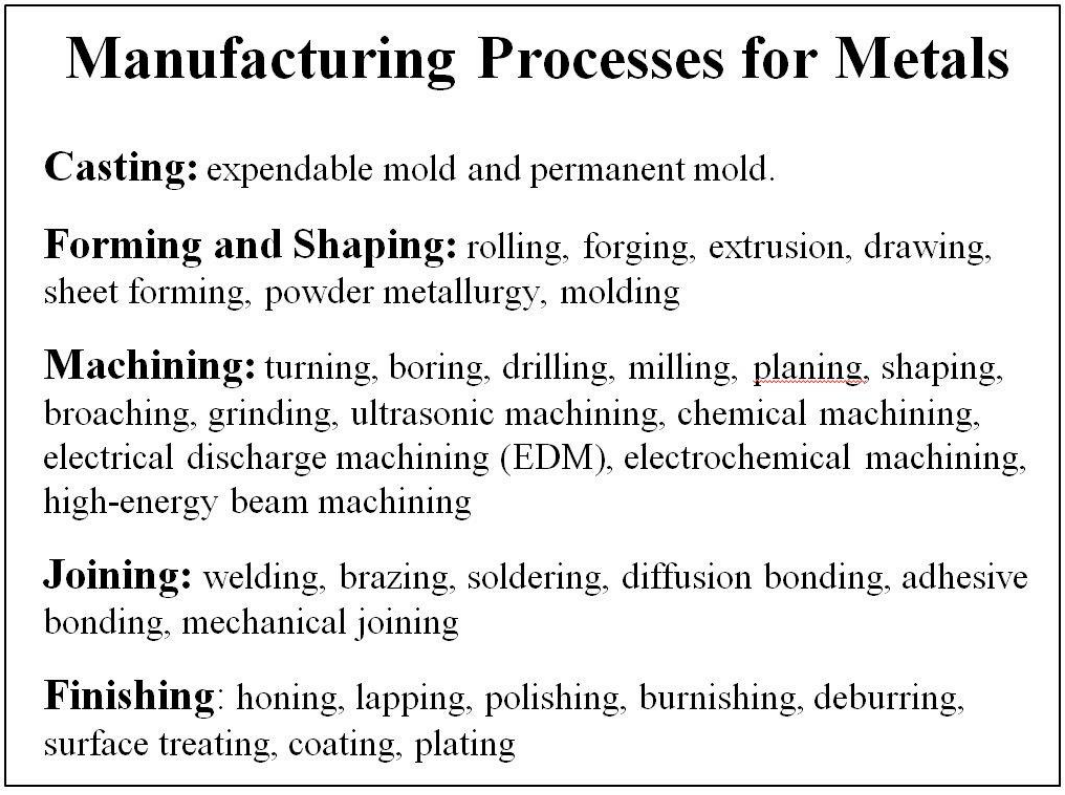


Figure 11a.4 Manufacturing processes for metals are numerous, and will depend on the metal used and the desired end product. It may also be determined by the equipment available in the machine shop. Above are listed some of the most common manufacturing processes for metals.

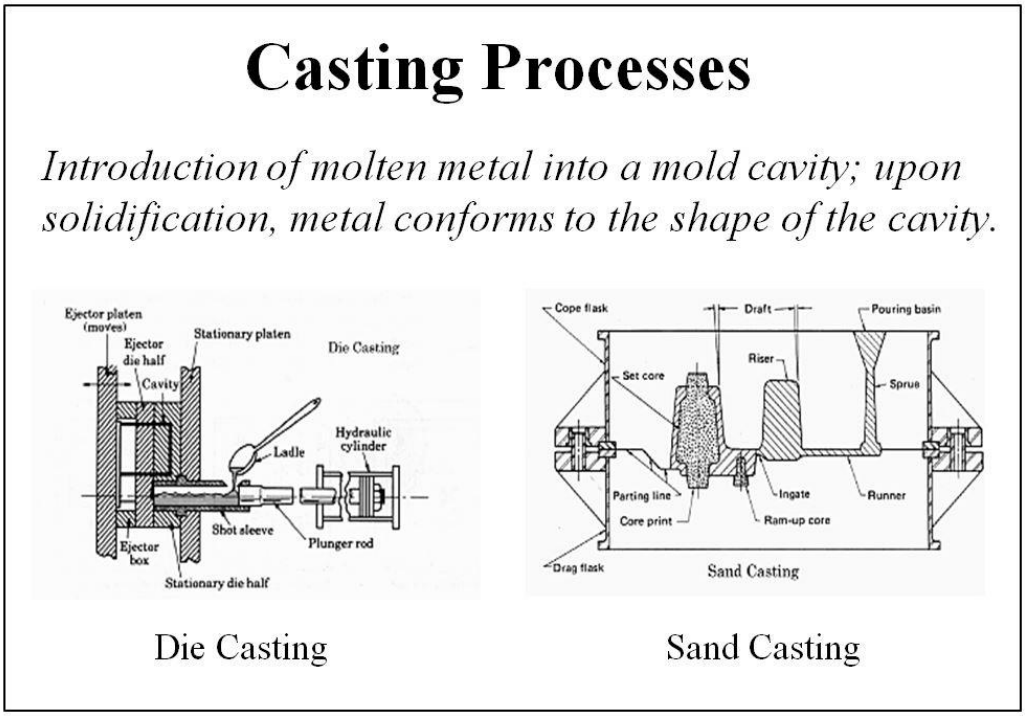


Figure 11a.5 Casting is common and reliable way to make metal parts. It consists of introducing molten metal into a mold cavity. Upon solidification, metal conforms to the shape of the cavity. Two common types are die casting and sand casting.

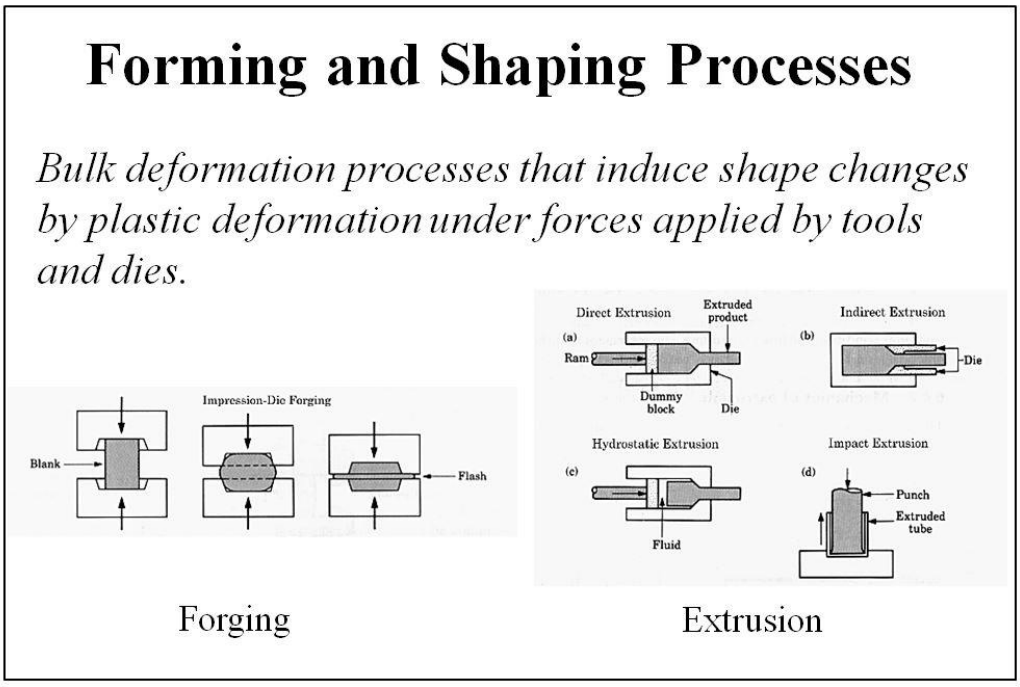
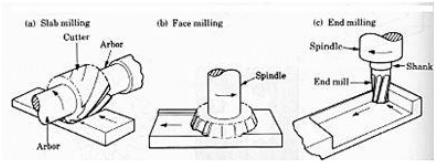
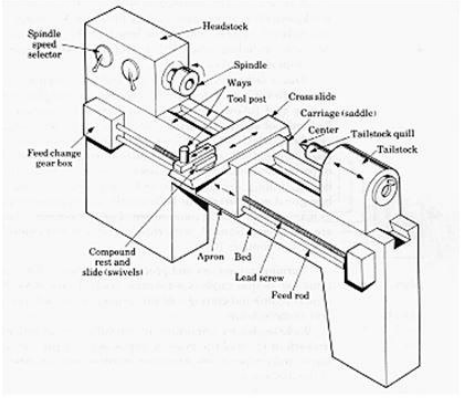


Figure 11a.6 Forging and shaping processes force material through tools and dies to deform it into a particular shape. Here is illustrated a forging process and an extrusion process.

Machining Processes

Material removal from a work piece: cutting, grinding, nontraditional machining processes.



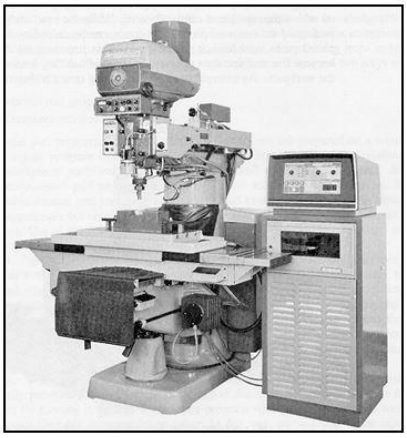


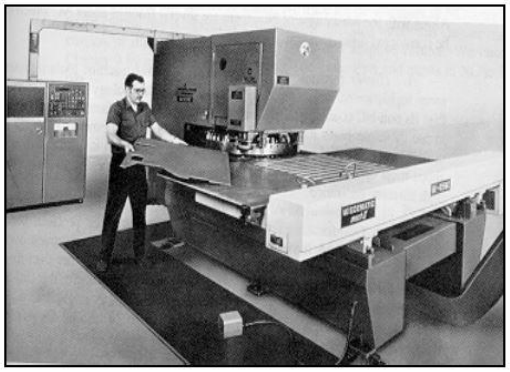
Milling

Lathe Machine

Figure 11a.7 Machine processes remove material from raw stock using traditional cutting machines such as a mill or lathe. These machines have been the backbone of machine shops for many decades.

Numerical Control (NC) Machining





NC Milling Machine

NC Punch Press Machine

Figure 11a.8 With the development of digital computers in the 1960's, many traditional machining processes started to be controlled by numerical code generated by digital computers.

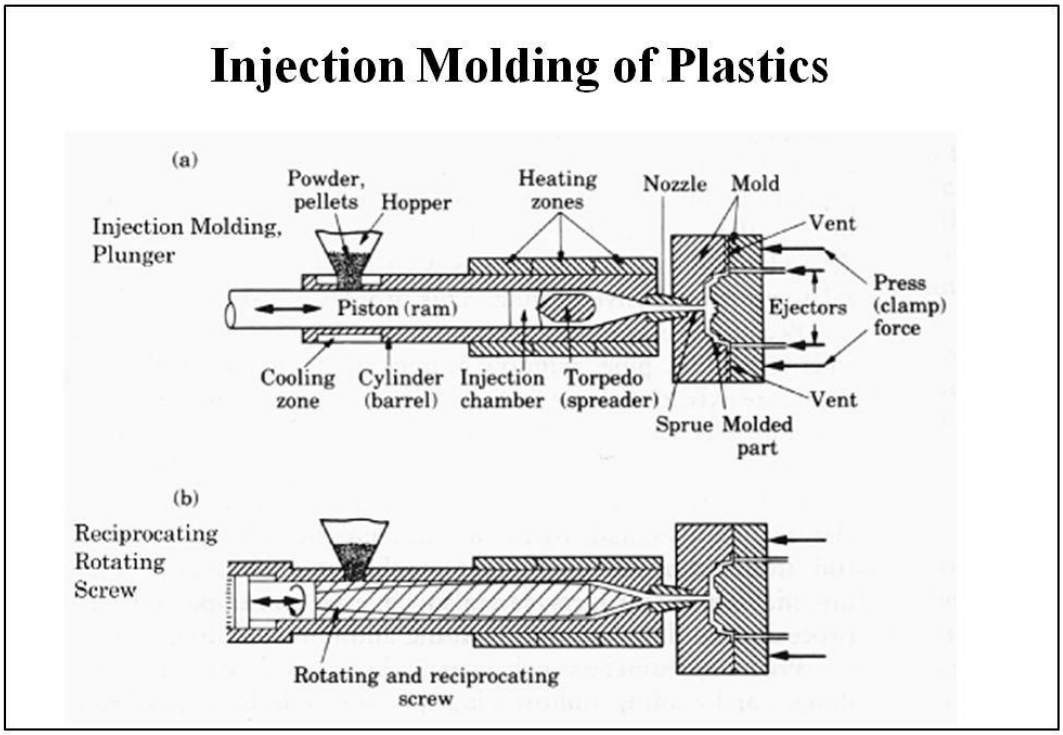


Figure 11a.9 With the development of ejection molding processes, plastic (in various forms) has become a very common material for product design and manufacturing. It has advantages in cost and weight, and the strength of plastic materials has been improving.

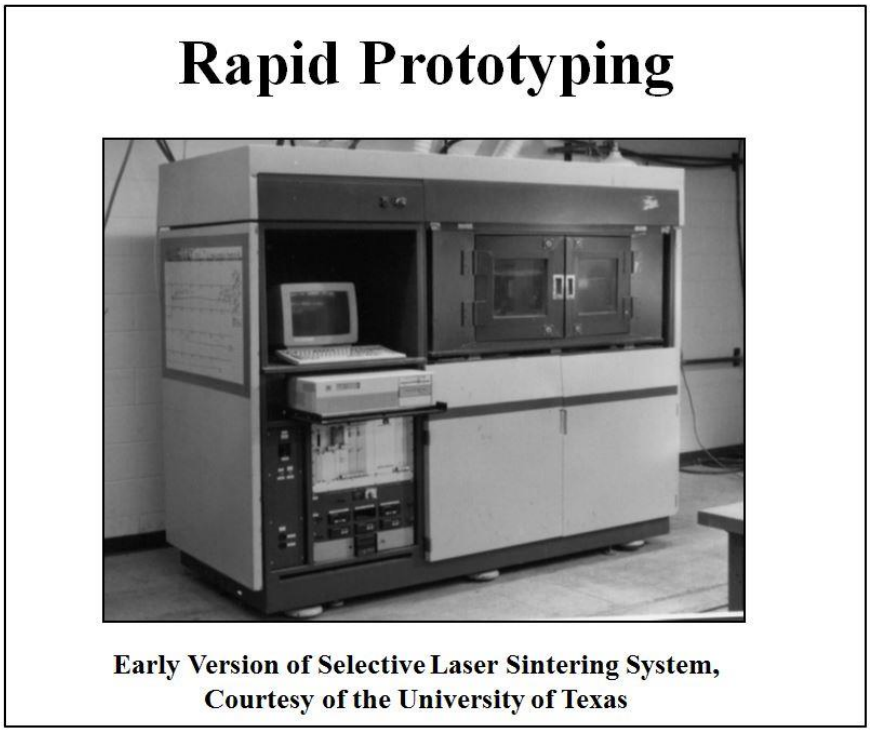


Figure 11a.10 Rapid prototyping machines have now become an attractive way to build parts directly from a 3-D computer model generated STL file.

Design Check #7
Materials and Manufacturing Team Project Assignment

Browse through engineering books and journals to find information about the materials and manufacturing processes that went into the fabrication of the parts used in your chosen mechanical assembly. Select one distinctive part from your chosen dissection assignment and write a brief description of the following (approx. 1-2 double-spaced pages):

- A brief description of the part.
- A brief description of the material used and why it was selected.
- A brief description of the manufacturing process used in its production.
- Include at least two reference citations for the write-up.

Some Useful References for This Assignment (others are possible)

Waterman, N.A. and Ashby, M.F. (Eds.): *The Materials Selector*, 2nd Ed., London: Chapman and Hall, 1997. (TA 403 E43)

Brady, G.S., Clauser, H.R., and Vaccari, J.A.: *Materials Handbook*, New York: McGraw-Hill, 1997. (TA 403 B75)

Harper, C.A.: *Handbook of Materials for Product Design*, New York: McGraw-Hill, 2001. (TA 403.4 H365)

Ashby, M.F., *Materials Selection in Mechanical Design*, 3rd. Ed. Boston: Elsevier Butterworth, 2005 (TA 403.6 A74)

Budinski, K. and Budinski, M.: *Engineering Materials: Properties and Selection*, 8th Ed., Upper Saddle River, N.J., 2005. (TA403 B787)

Clauser, H.R.,. Ed., *Encyclopedia/Handbook of Materials, Parts and Finis*hes, Westport, Conn., Technomic Pub., 1976. (TA402 E5)

Gale Research, *How Products are Made*, http://www.madehow.com, 1994. (TS 145 H67)

Rose, S. and Schlager, N.: *How Things are Made, from Automobiles to Zippers*, New York, Black Dog and Leventhal Pub., 2003. (TS 183 R67)

Kalpajian, S. and Schmid, S.: *Manufacturing Processes for Engineering Materials*, Upper Saddle River, N.J., 2003. (TS 183 K34)

Team Name _____ Unique No. _____

Design Check No. 7 Grading Form

Grade

Cover Sheet (5 points)
1. Semester and Year
2. Project Title
3. Team Name and Logo
4. Team Members Names, Emails, Leader
5. Instructor Name and Section Unique No.

Selection of Part (5 points)
1. Part Selection
2. Part Description
3. Rationale for Part Selection
4. Image of Part
5. Writing Style and Grammar

Material Analysis (5 points)
1. Part Material Identified
2. Material Properties
3. Rationale for Material Used
4. Reference Citation Identified
5. Writing Style and Grammar

Manufacturing Analysis (5 points)
1. Manufacturing Process Identified
2. Manufacturing Process Description
3. Rationale for Manufacturing Process
4. Reference Citation Identified
5. Writing Style and Grammar.

References Cited (5 points)
1. Reference #1
2. Reference #2
3. Citation Style for #1
4. Citation Style for #2
5. Citation Completeness

Total Grade (25 points max.)