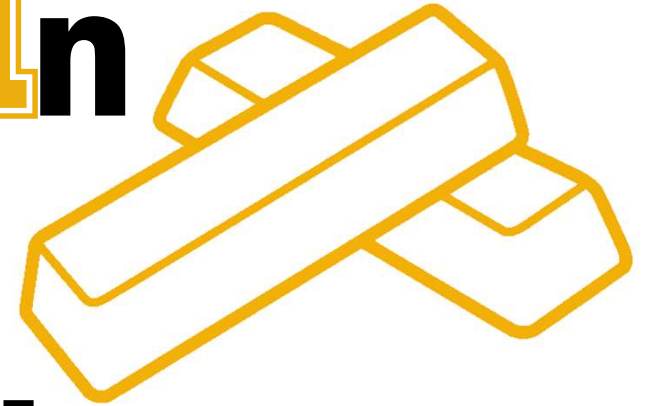


Mechanics**I** **n** **Design and** **Manufacturing**



+ Introduction

What does this course cover?

- Nature of Materials
 - Structure
 - Behavior
 - Testing
- Processing/Manufacturing
 - Solidification
 - Powder
 - Deformation
 - Material Removal
 - Joining
- Design for Manufacture

Nature of Materials

- Materials and Crystal Structure
- Strengthening Mechanisms
- Defects and Dislocations
- Flow Theories
- Hardness Testing
- Contact Mechanics
- Material Classes
 - Metals
 - Ceramics
 - Polymers
 - Composites

Manufacturing and Design

- Composite Materials
- Metal Casting
- Glassworking
- Polymer Processing
- Powdered Metal Processing
- Metalworking
- Rolling
- Forging
- Extrusion
- Machining
- Heat Treatment
- Welding
- Assembly
- Additive Manufacturing
- Electronics Manufacturing

Course Requirements

- Homework/Quiz – 25%
 - ~2 HW/week
 - Readings
 - Occasional Quizzes
- Mid-Term Exams (3) – 45%
- Final Exam – 30%

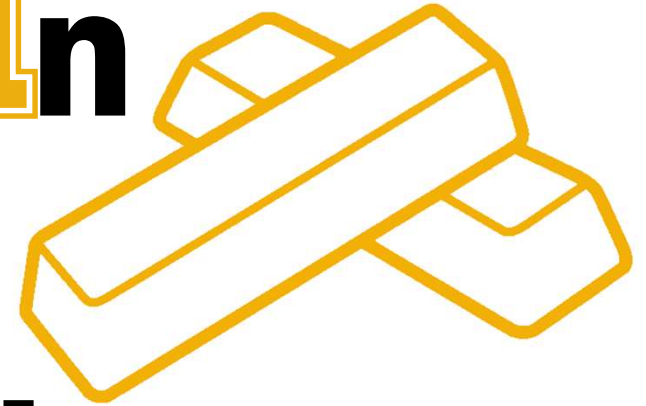
Expectations

Participation

Questions

Sharing

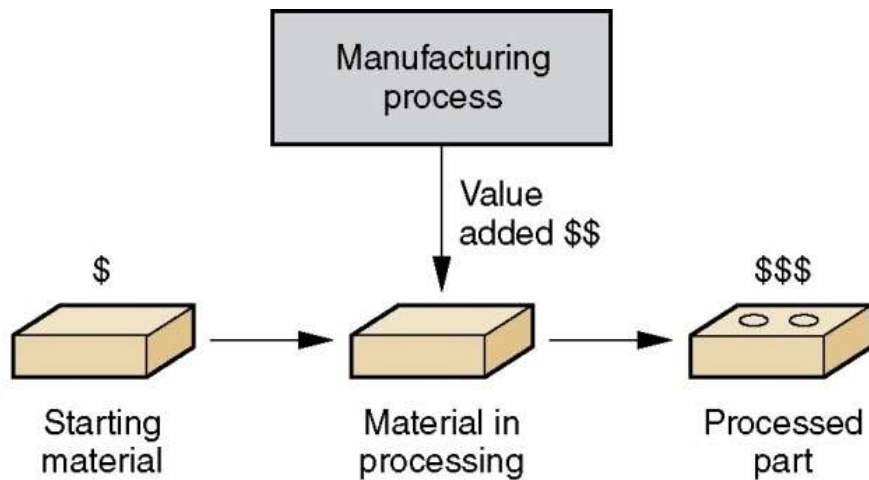
Mechanics**I** **In** **Design and** **Manufacturing**



+ What is Manufacturing?

Manufacturing

The transformation of materials into items of greater value by means of altering the geometry, properties, and/or appearance of a raw material or materials.

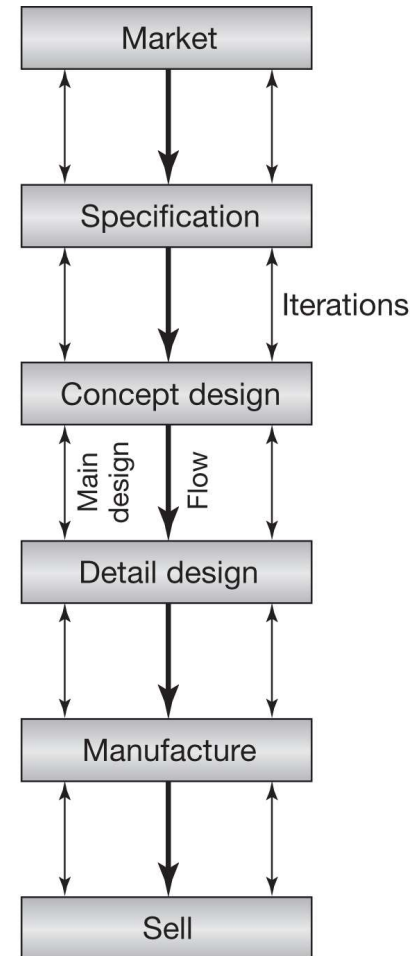


Manufacturing Demands

- Design requirements
- Economical and environmentally friendly
- Quality
- Flexible/On-time
- Evaluation of new materials/techniques
- A system approach
- Sourcing (often globally)
- Continuous improvement and productivity

Design and Concurrent Engineering

- 70-80% of the cost of manufacturing and environmental impact is determined during initial stages of product development



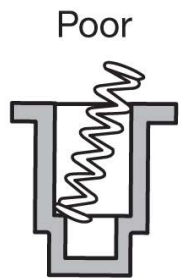
Design/Process must eventually progress to readiness level 9

TABLE 1.2 Definitions of Technology Readiness Level (TRL) and Manufacturing Readiness Level (MRL).

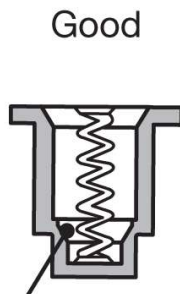
TRL	Description	MRL	Description
1	Basic principles observed and reported	1	Manufacturing feasibility assessed
2	Technology concept and/or application formulated	2	Manufacturing concepts defined
3	Analytical and experimental critical function and/or characteristic proof of concept	3	Manufacturing concepts developed
4	Component and/or breadboard validation in a laboratory environment	4	Capability to produce the technology in a laboratory environment
5	Component or breadboard validation in a relevant environment	5	Capability to produce prototype components in a production relevant environment
6	System/subsystem model or prototype demonstration in a relevant environment	6	Capability to produce a prototype system or subsystem in a production relevant environment
7	System prototype demonstration in an operational environment	7	Capability to produce systems, subsystems or components in a production representative environment
8	Actual system completed and qualified through test and demonstration	8	Pilot line capability demonstrated; ready to begin low rate initial production
9	Actual system proven through successful mission operations	9	Low rate production demonstrated; capability in place to begin full rate production

Design For Manufacture

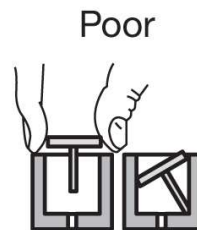
- Integrates the product design process with



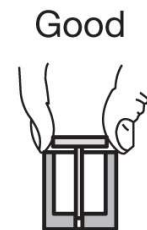
Parts can hang up



Chamfer allows part to fall into place



Part must be released before it is located



Part is located before release

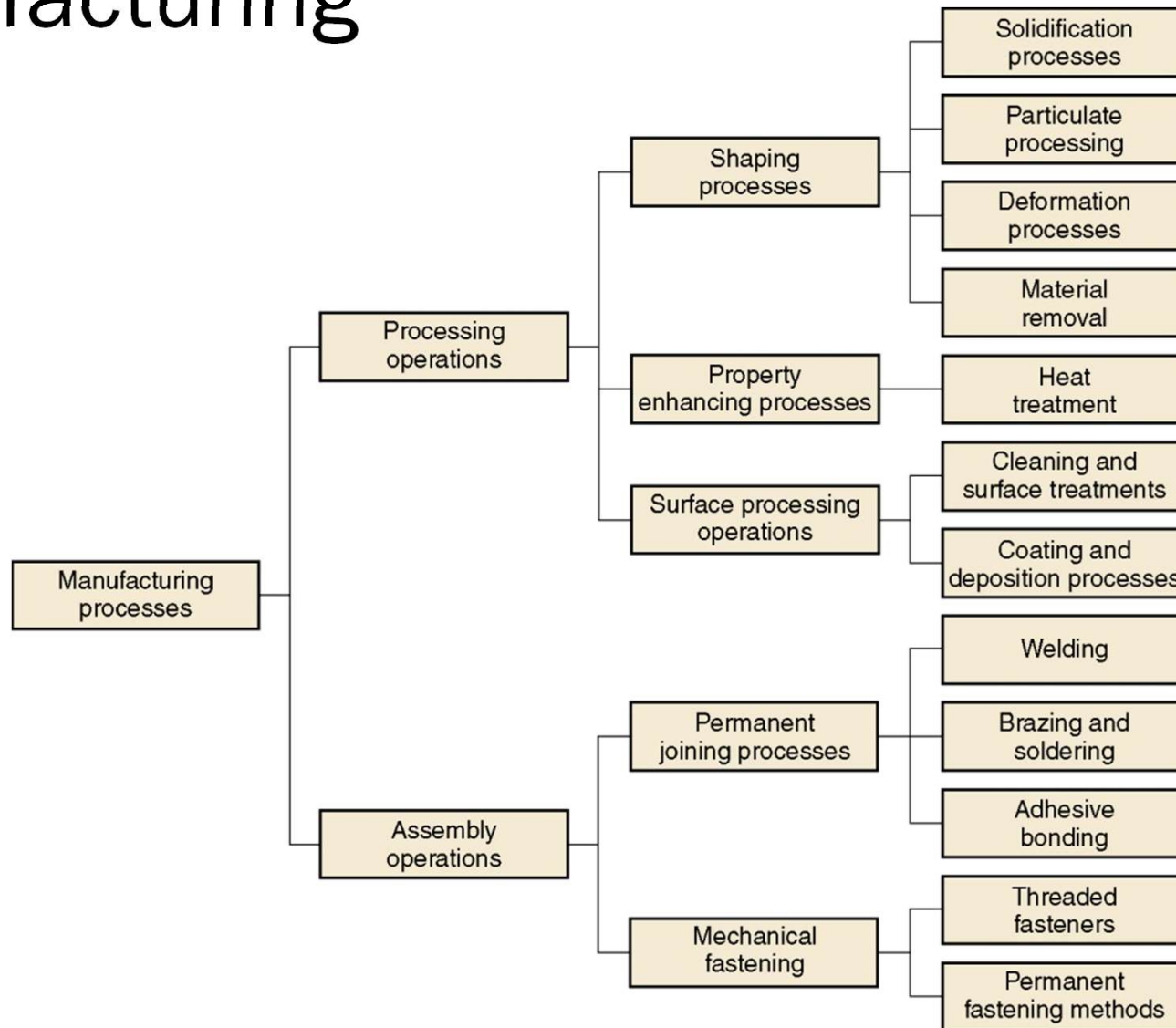


Can easily tangle



Will tangle only under pressure

Manufacturing



Classification of Engineering Materials

