

WELCOME

TO

332

Manufacturing Technology

ABOUT ME

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CHAPTER 1.1

INTRODUCTION

TO

Manufacturing Technology

Text Book

- **Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Mikell P. Groover, forth Edition, 2010 John Wiley & Sons Inc.**
- **Manufacturing Engineering and Technology, Serope Kalpakjian, Sixth Edition, 2010, Prentice Hall.**
- **Lecture Notes**

Regular Laboratory

- 1) Casting
- 2) Bulk Metal Forming
- 3) Sheet metal processes
- 4) Welding processes
- 5) Heat treatment

COURSE ASSESSMENT

- **GRADING**

- **Homework and Attendance** **10**
- **Mid Term Exam** **30**
- **Lab** **20**
- **Final Exam** **40**

WHAT IS MANUFACTURING ?

Inspect various objects around you your pen, lamp, calculator, telephone, chair, and light fixtures. You will soon realize that all these objects had a **different shape** at one time. You could **not find them in nature** as they appear in your room. **They have been transformed from various raw materials and assembled into the shapes that you now see.**

Manufacturing Technology

Manufacturing is the process of converting raw materials into products.

Technology can be defined as the application of science to provide society and its members with those things that are needed or desired. Technology affects our daily lives, directly and indirectly, in many ways.

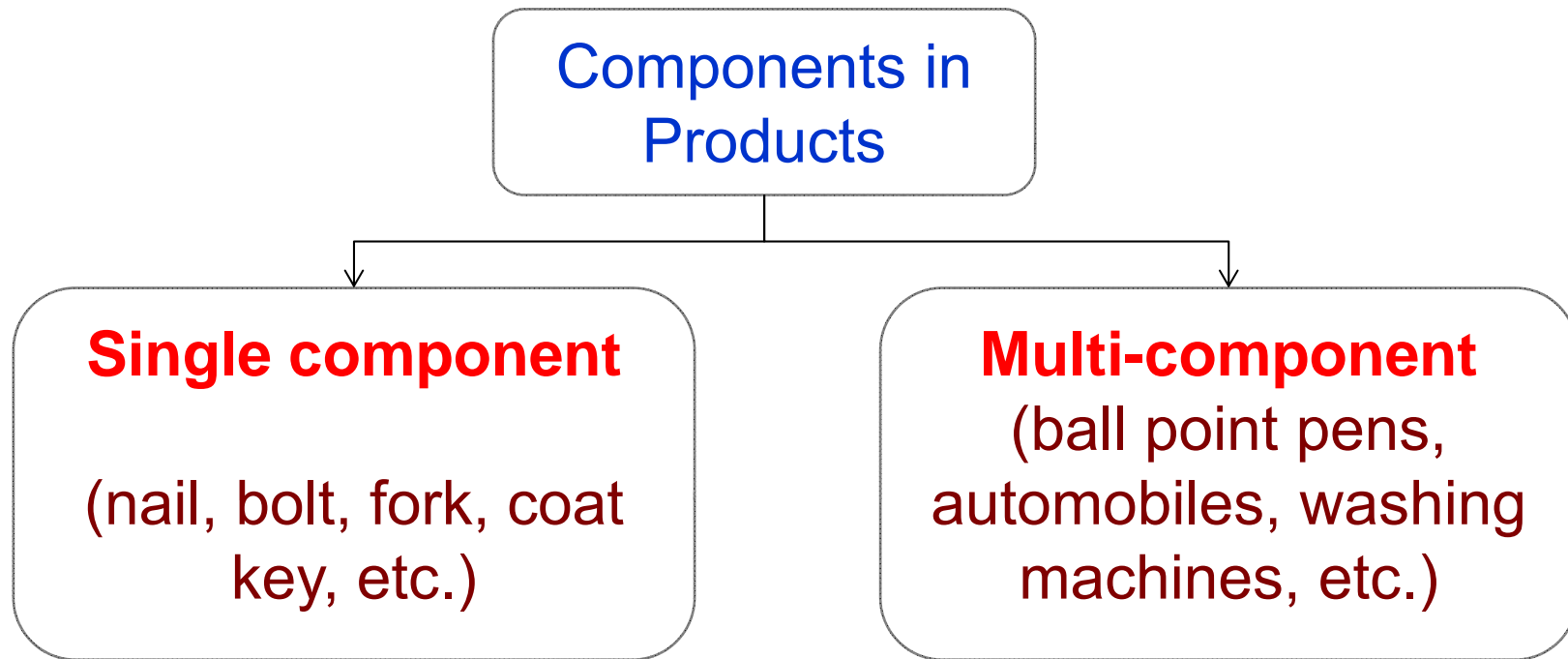
SYLLABUS

- ❖ Casting processes (solidification and melting, furnaces, expendable and permanent mold casting).
- ❖ Bulk deformation processes (hot and cold forming processes, workability and limits of forming)
- ❖ Sheet metal processes (formability of sheets and sheet forming processes, processing of polymers).
- ❖ Metal powders and ceramics
- ❖ Welding processes.
- ❖ Heat treatment of metals.
- ❖ Principles of metal cutting (machining processes, types of chips, process sheet).

Chapter 1: Introduction

Manufacturing includes three main stages:

1. The **design** of the product
2. The selection of raw **materials**
3. The sequence of **processes** through which the product will be manufactured.



- All components are manufactured.
- Manufacturing means, *“Made by Hand”*.

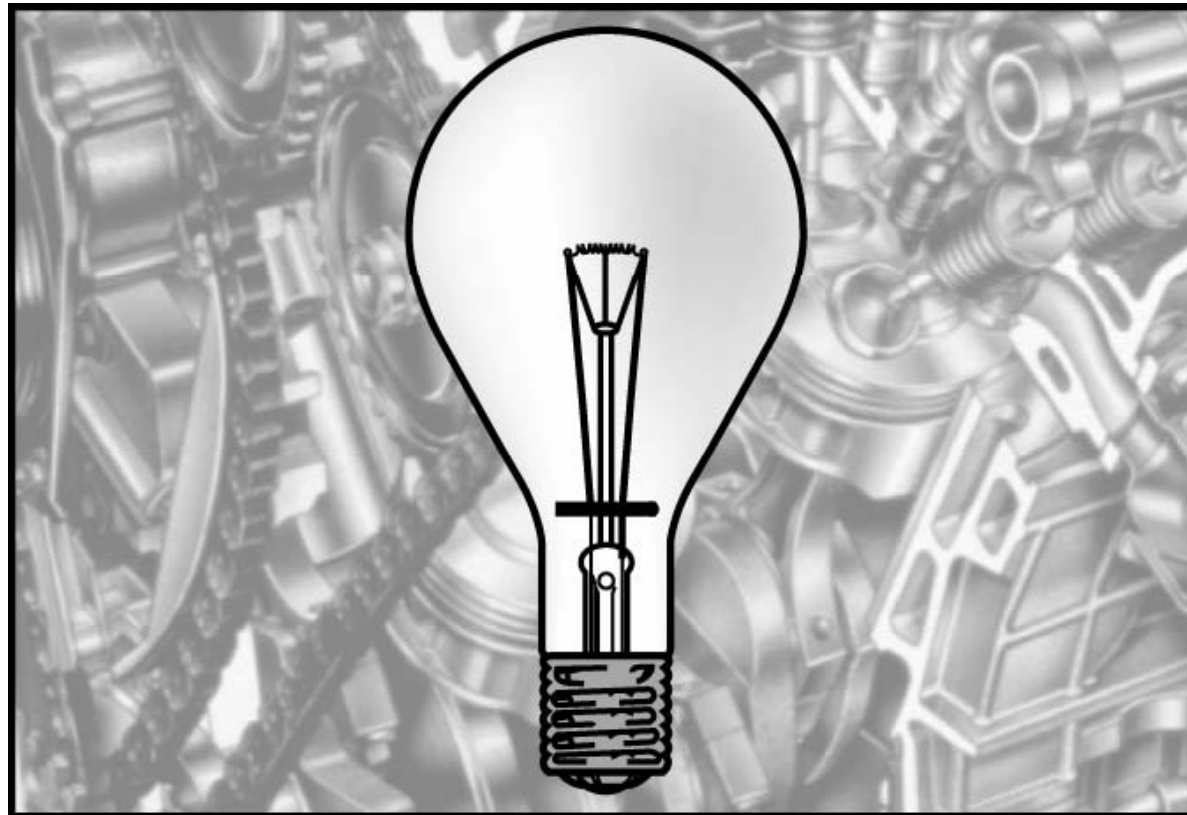
TABLE I.1

Number of Parts in Some Products

Product	Number of parts
Rotary lawn mower جزارة العشب الدوارة	300
Grand piano	12,000
Automobile	15,000
C-5A transport plane	> 4,000,000
Boeing 747-400	> 6,000,000

Example of Assembled Products

The first Incandescent lamp was made by T.A. Edison (1847-1931) in New Jersey and was first lit in 1879.



Manufacture of Light Bulbs

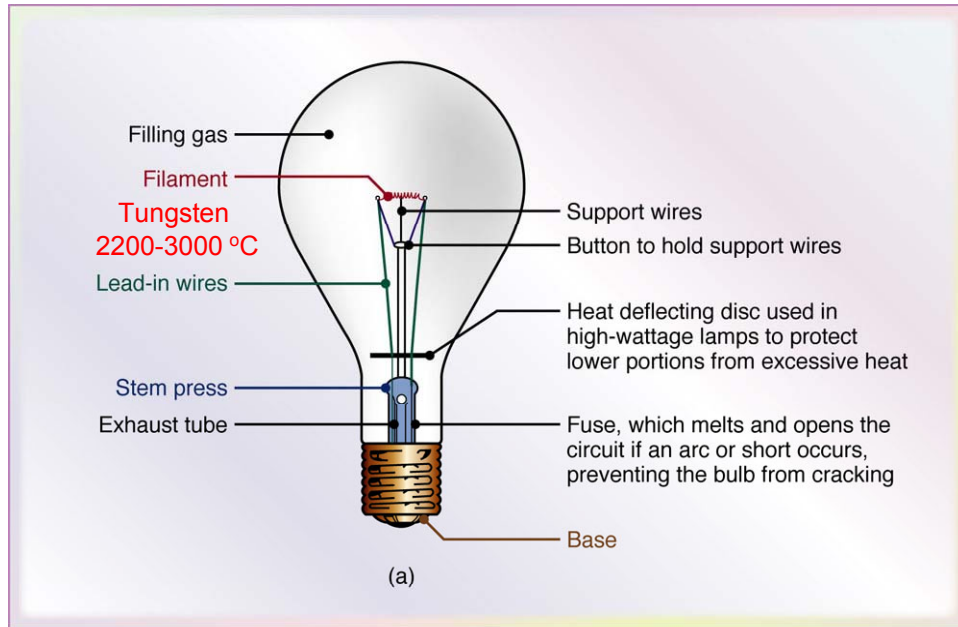


Figure I.3a Components of a common Incandescent light bulb.
Source: Courtesy of General Electric Company.

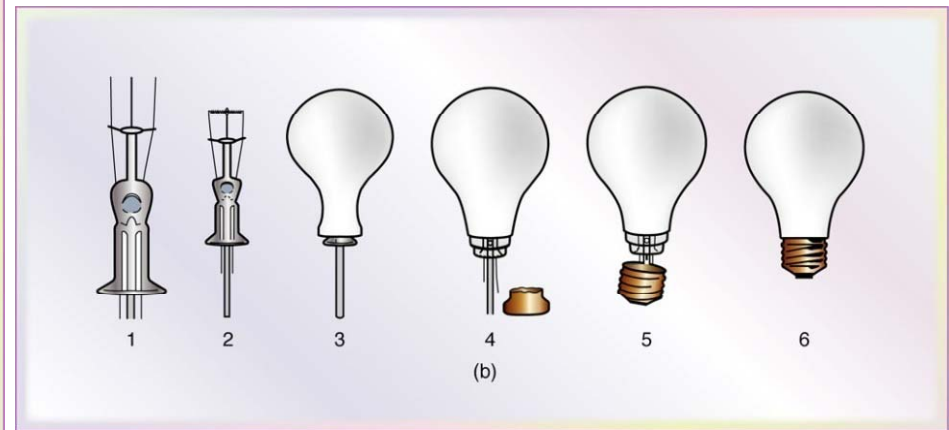


Figure I.3b Manufacturing steps in making an incandescent light bulb.
Source: Courtesy of General Electric Company.

Materials in an Automotive Engine

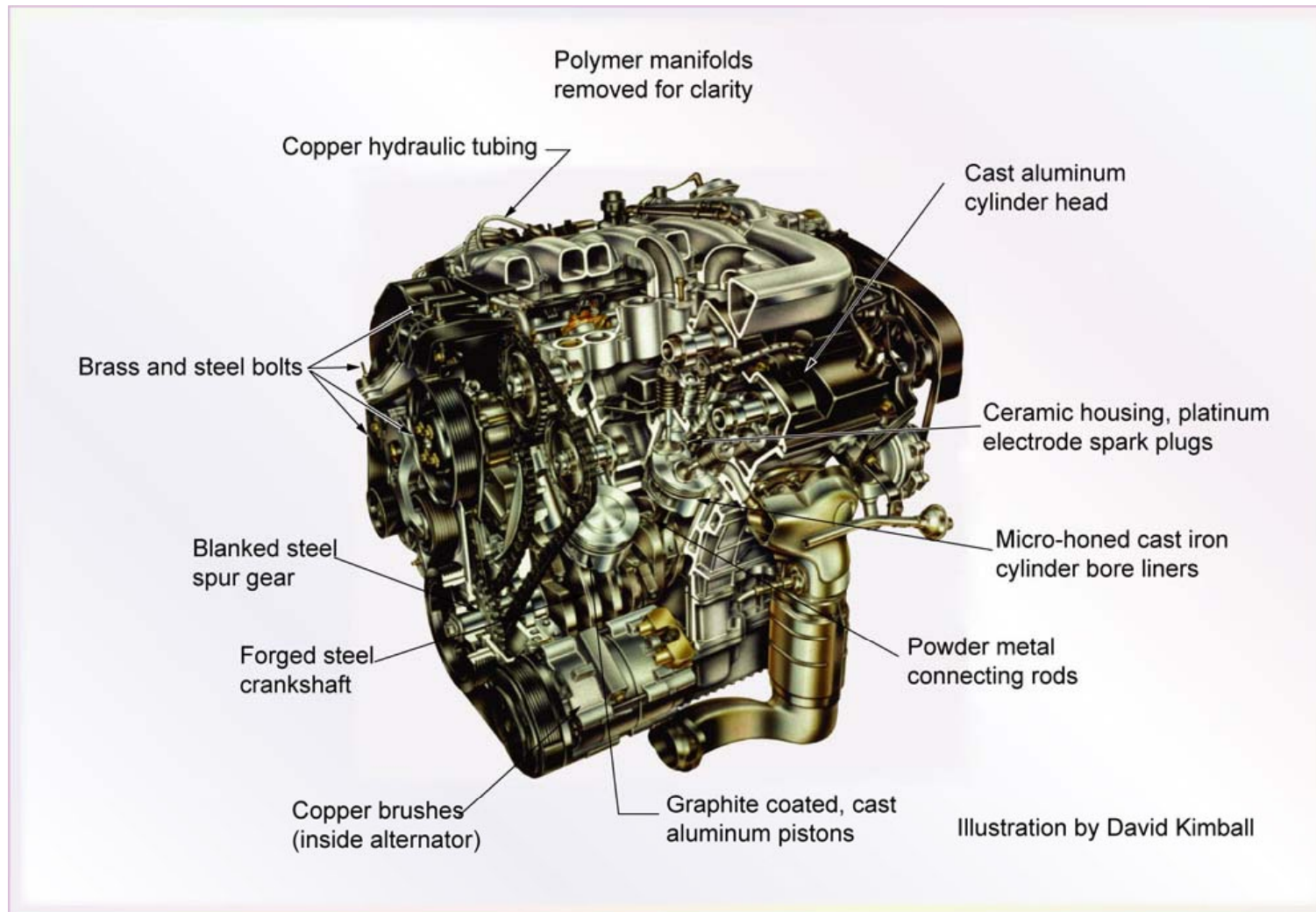


Figure I.1 Section of an automotive engine - the Duratec V-6 - showing various components and the materials used in making them.

(Source: Courtesy of Ford Motor Company. Illustration by David Kimball.)

Materials Selection for Paper Clips



Questions for consideration:

- What material **properties** are required?
- What **manufacturing** attributes are required?
- Would the material and processing strategy change if the desired **quantity** was **10,000** vs. **1 million** per day?

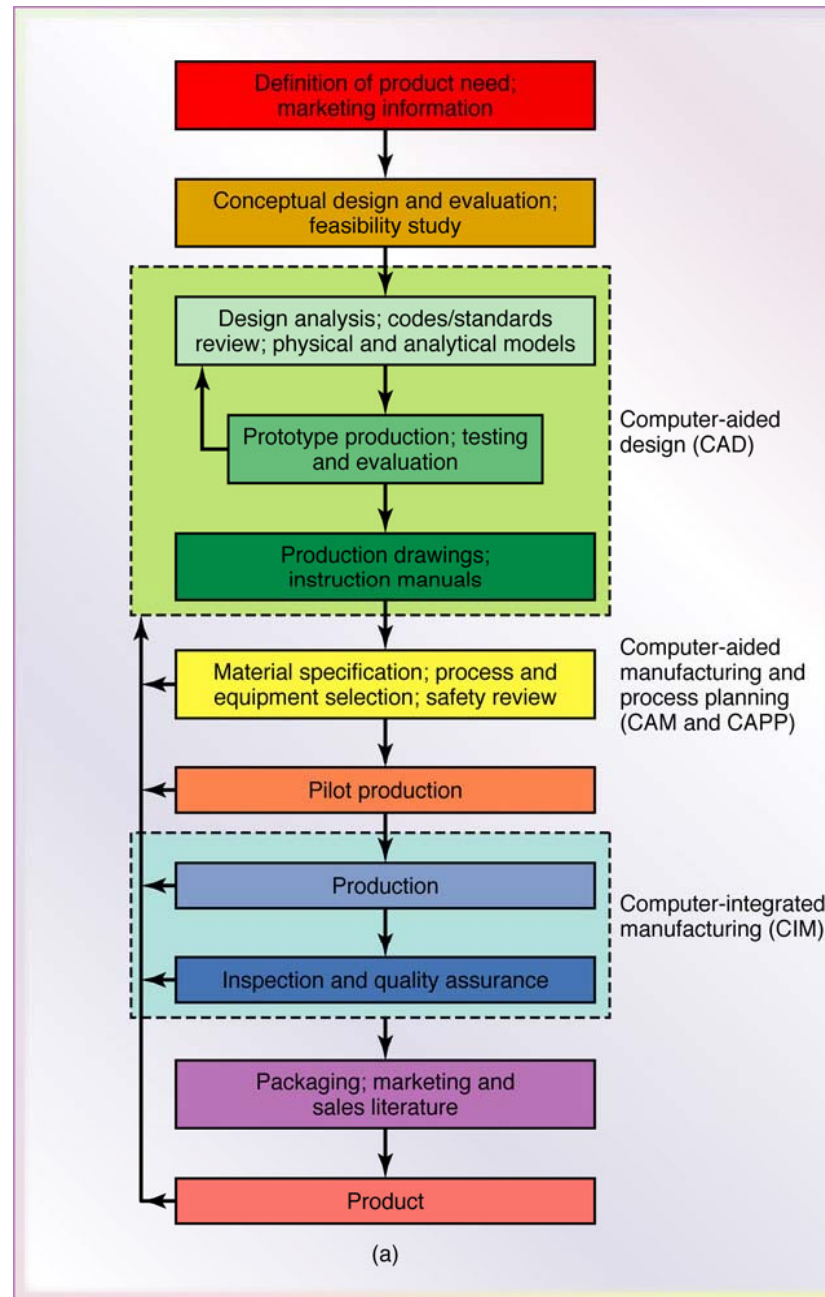
Figure I.2 Examples of the wide variety of materials and geometries for paper clips.

Product Design **Process**

Figure I.3

Depending on the **complexity** of the product and the type of **materials** used, the **time** span between the original concept and the marketing of the product may range from a **few months to many years**.

Various steps involved in design and manufacturing a product.



Redesign of Parts

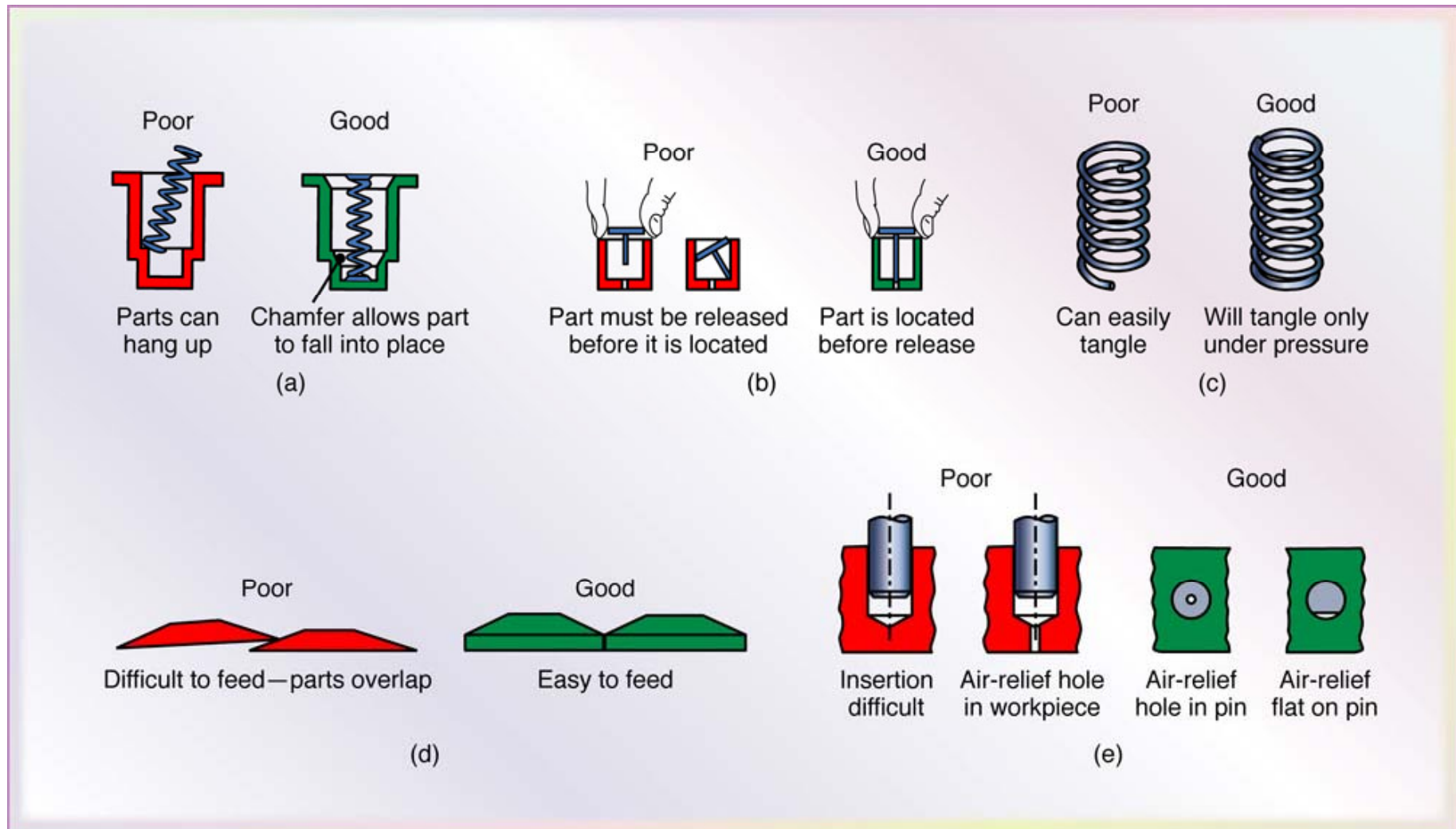


Figure I.4 Redesign of parts to facilitate assembly.

Source: Reprinted from G. Boothroyd and P. Dewhurst, *Product Design for Assembly*, 1989. Courtesy of Marcel Dekker, Inc.

Manufacturing **Characteristics** of Alloys

TABLE I.3

General Manufacturing Characteristics of Various Alloys

Alloy	Castability	Weldability	Machinability
Aluminum	E	F	E-G
Copper	G-F	F	G-F
Gray cast iron	E	D	G
White cast iron	G	VP	VP
Nickel	F	F	F
Steels	F	E	F
Zinc	E	D	E

Note: E, excellent; G, good; F, fair; D, difficult; VP, very poor.

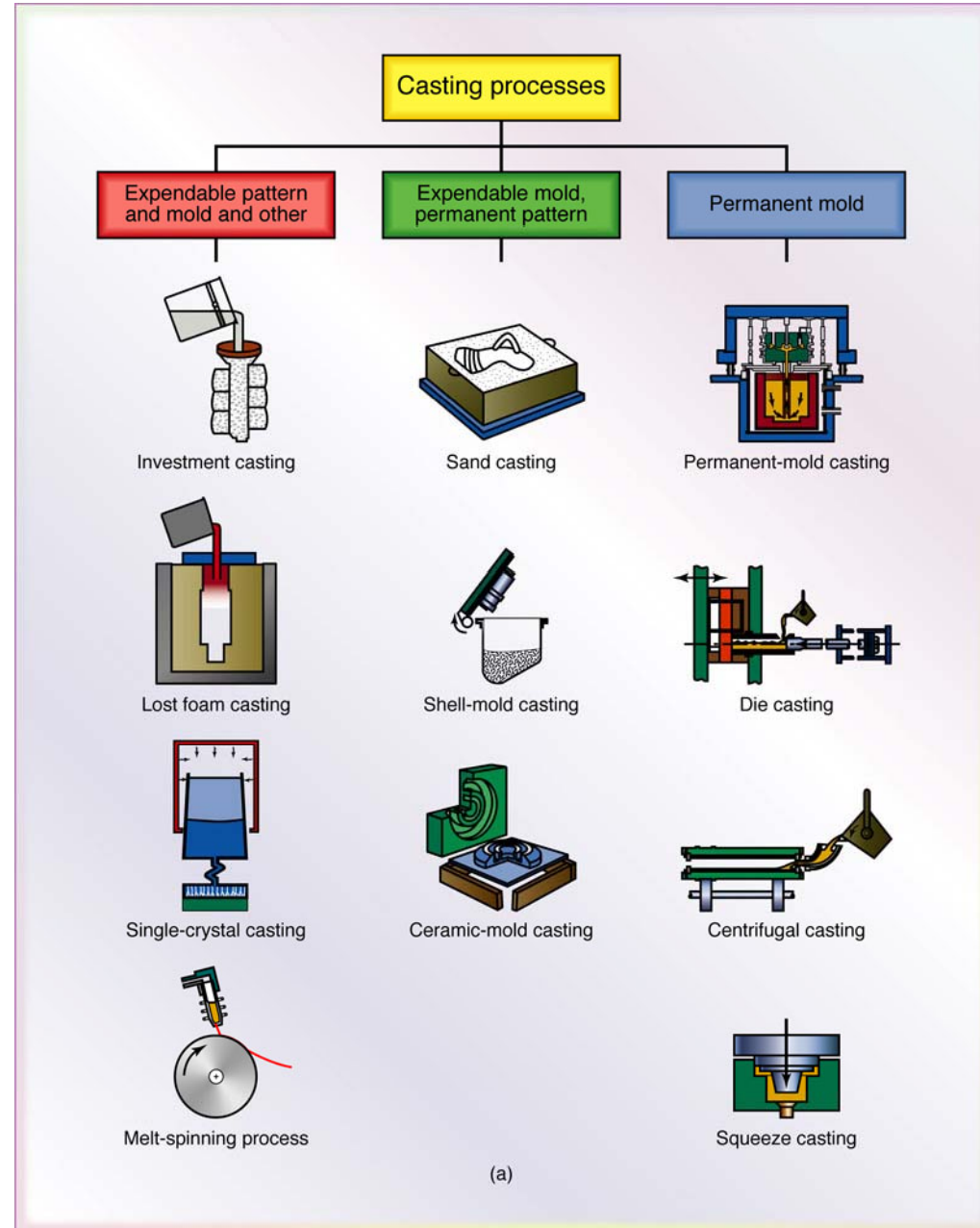
Baseball Bat Cross-sections

Figure I.5 Cross-sections of baseball bats made of aluminum (top portion) and composite material (bottom portion).



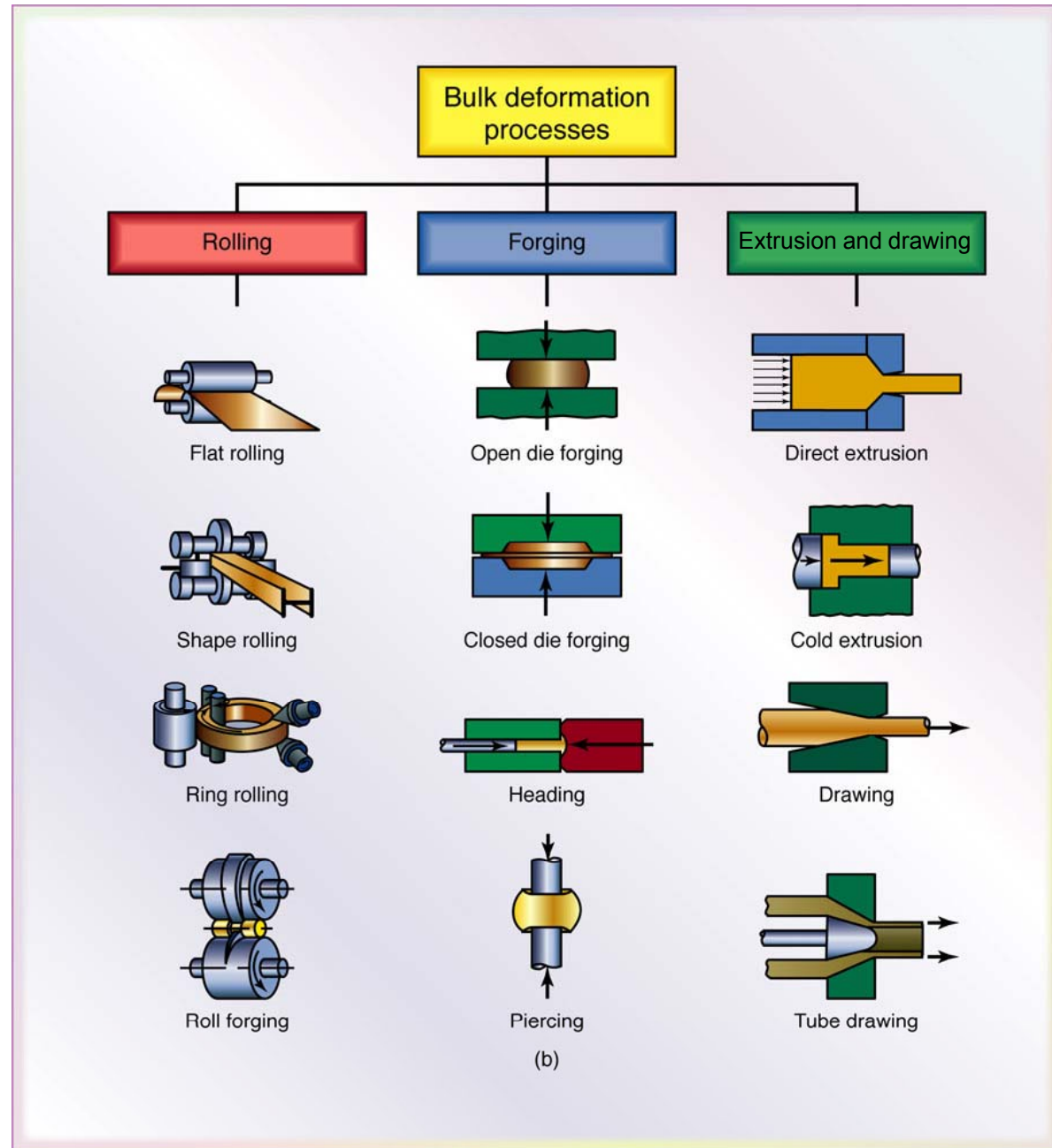
Manufacturing Processes: Casting

Figure I.6a Schematic illustration of various casting processes



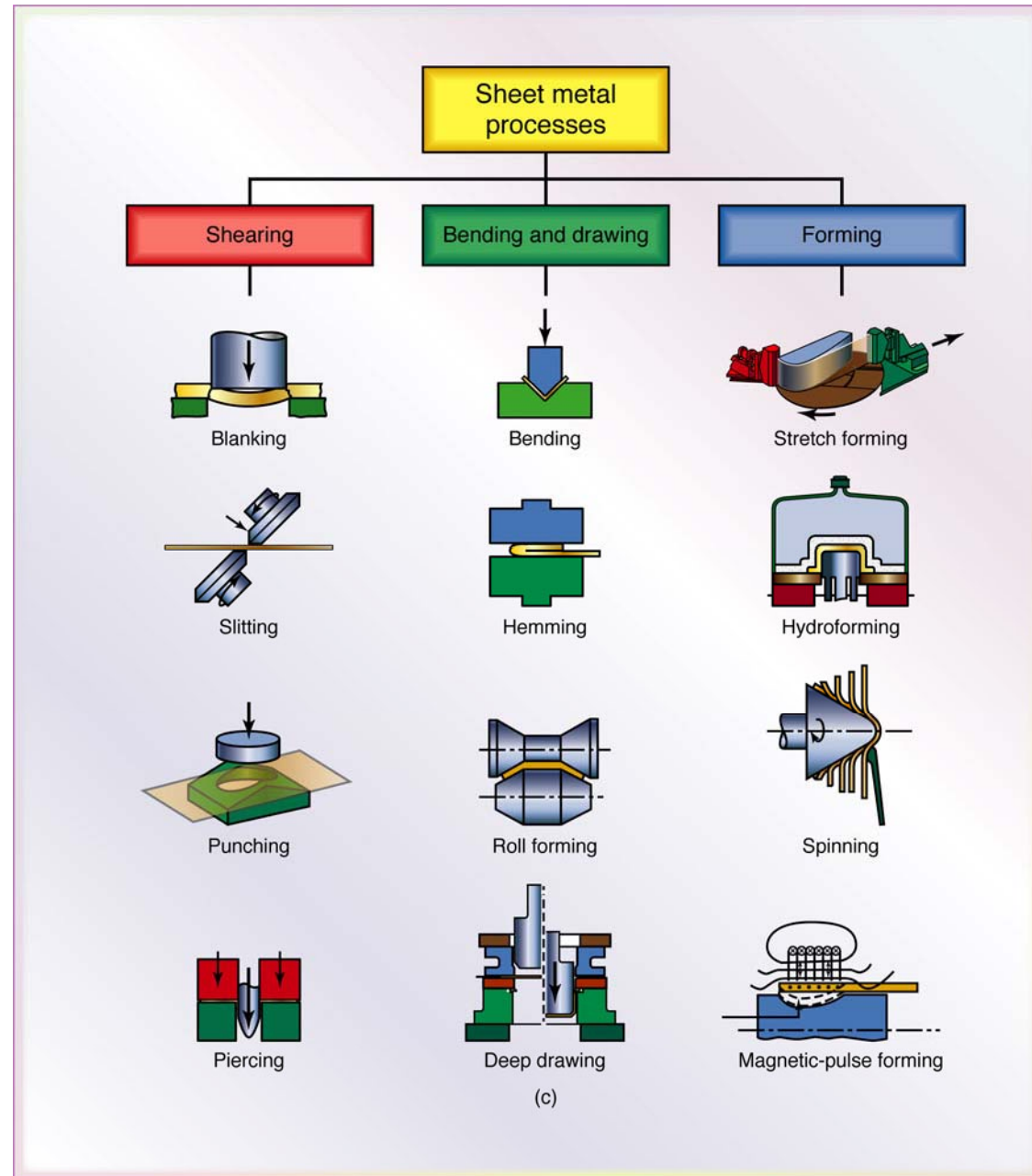
Manufacturing Processes: Forming and Shaping

Figure I.6b Schematic illustration of various bulk deformation processes



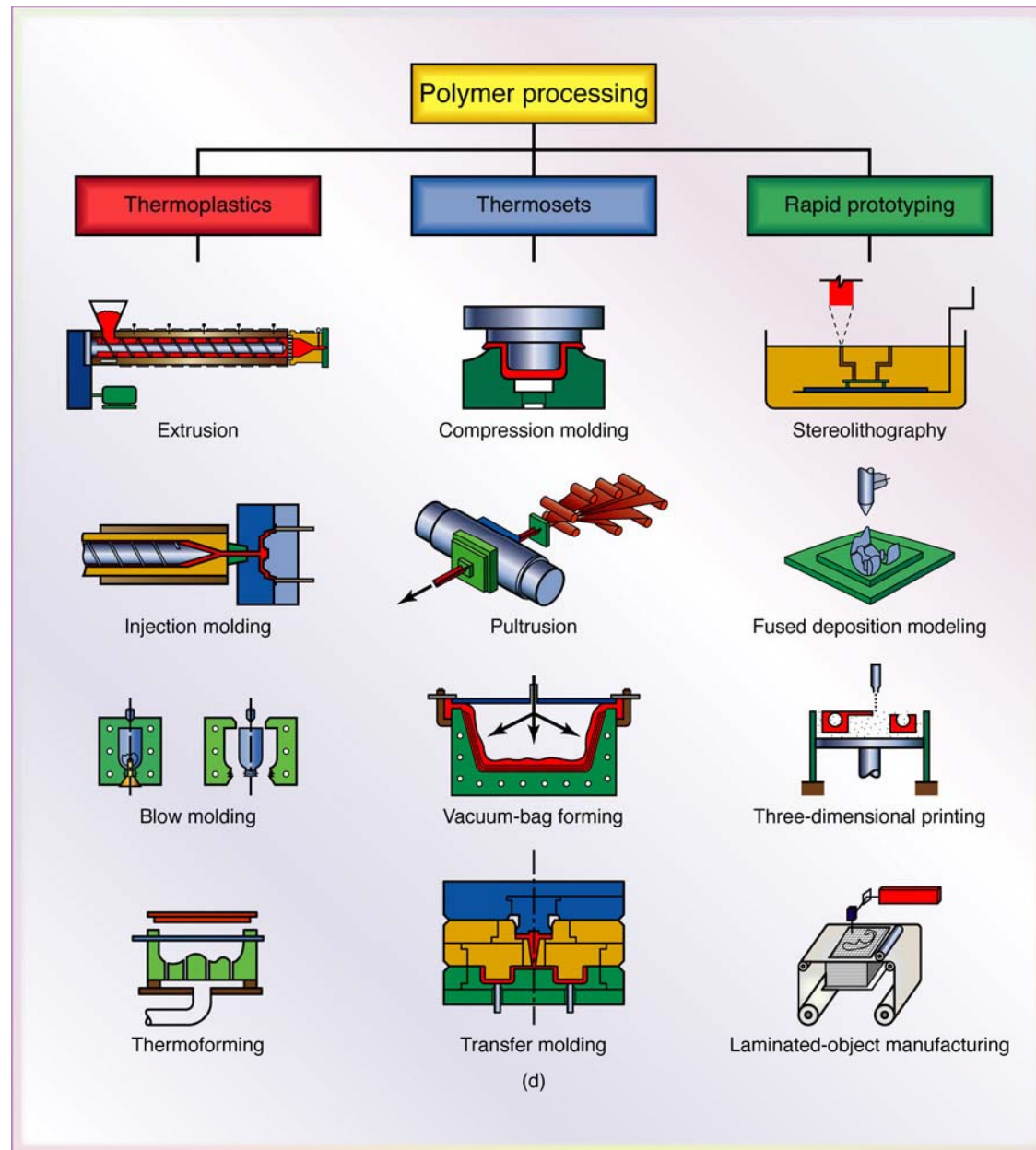
Manufacturing Processes: Forming and Shaping

Figure I.6c Schematic illustration of various sheet metal forming processes



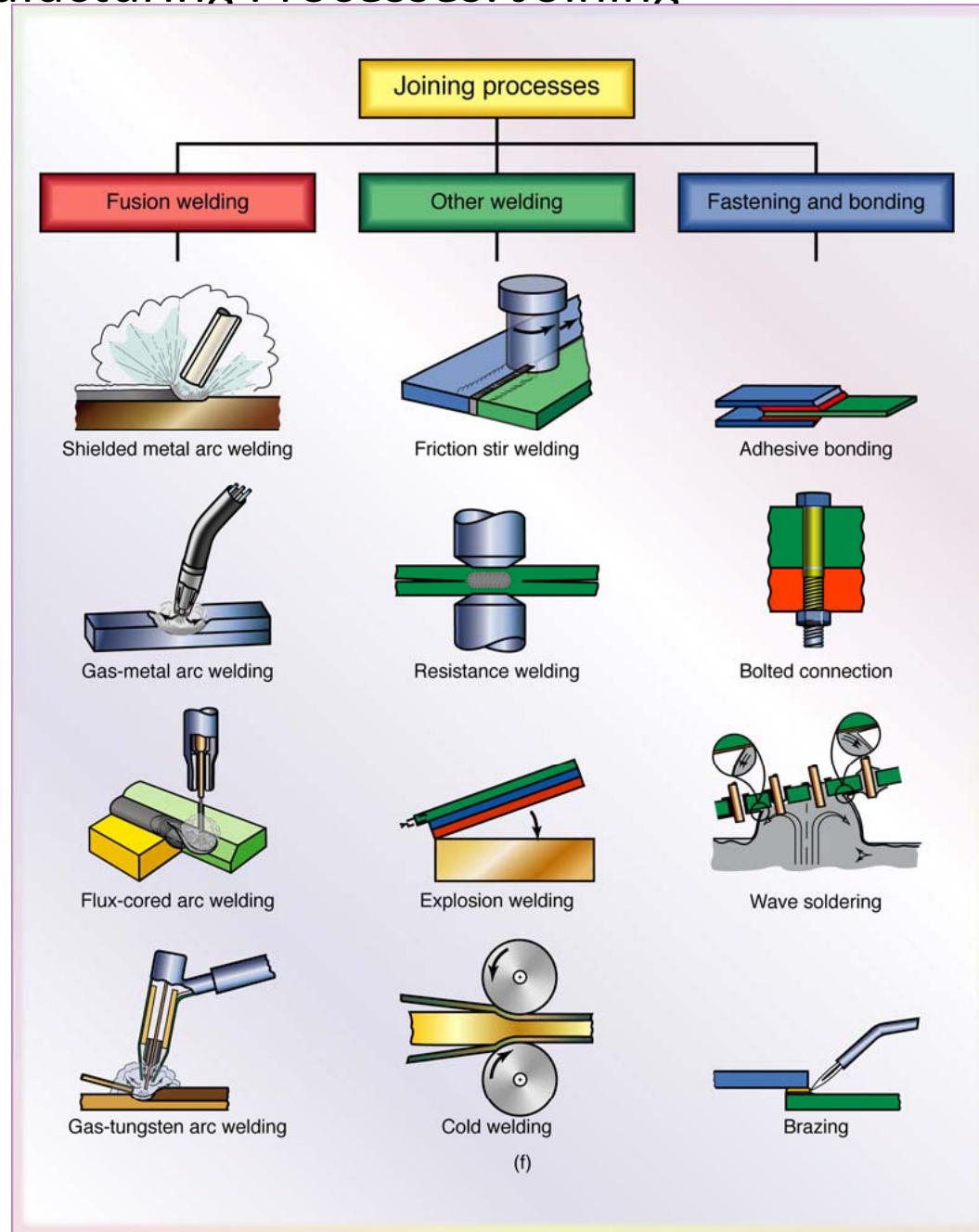
Manufacturing Processes: Forming and Shaping

Figure I.6d Schematic illustration of various polymer processing methods



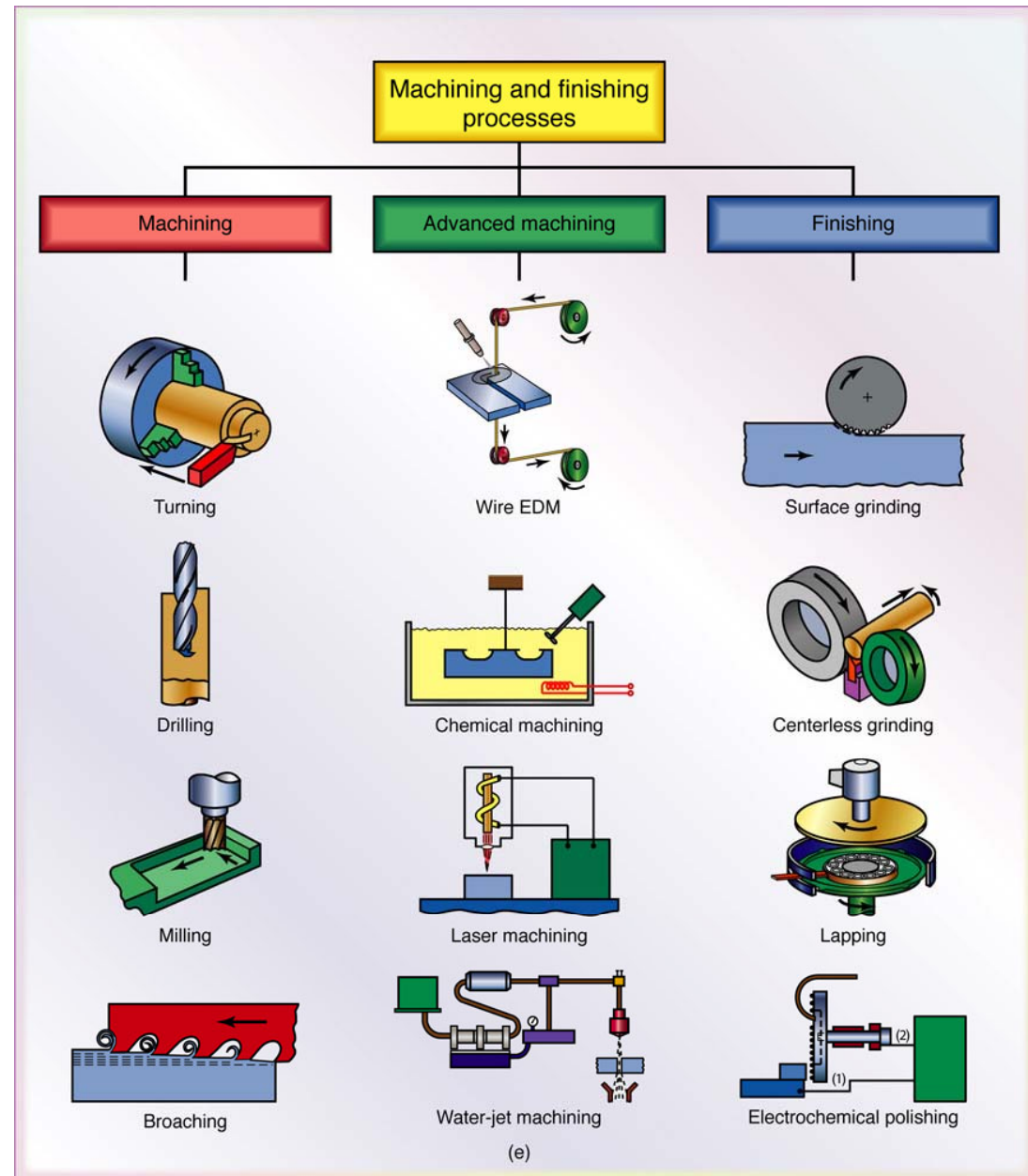
Manufacturing Processes: Joining

Figure I.6f Schematic illustration of various joining processes



Manufacturing Processes: Machining

Figure 1.6e Schematic illustrations of various machining and finishing processes.



Automated **welding** of automobiles



Figure I.7 Automated spot welding of automobile bodies in a mass production line.

Source: Courtesy of Ford Motor Company.

Application of CAD/CAM to make sunglasses mold

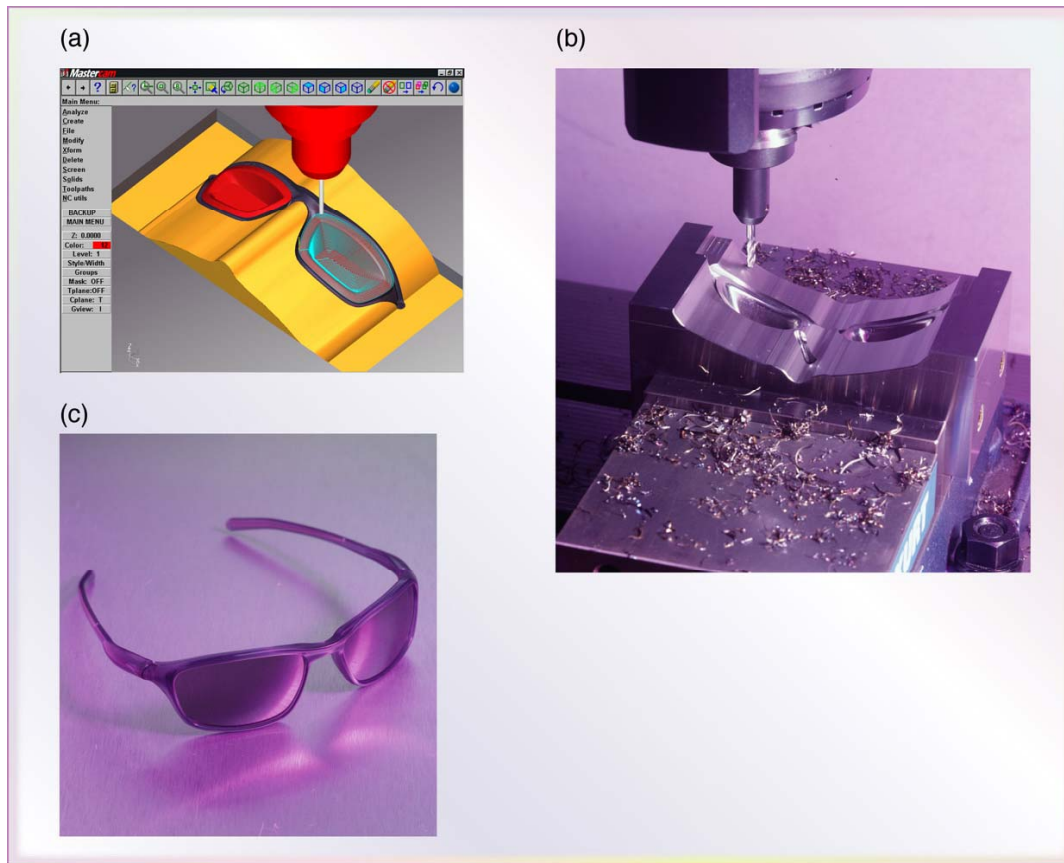


Figure I.8 Machining a mold cavity for making sunglasses.

(a) **Computer model** of the sunglasses as **designed** and viewed on the monitor.

(b) **Machine** the **die cavity** using a computer numerical-control milling machine

(c) Final product.

Source: Courtesy of Mastercam/CNC Software, Inc.