

Chapter 1 – Introduction

Qualitative Questions for Chapter 1

- 1 Compare and contrast the typical physical properties of metals, ceramics, and polymers. (Generalization is expected; there will be specific exceptions to any statement you make.)
- 2 Briefly describe the different dimensional scales that are used to characterize the structure of a material.
- 3 Describe some common trade-offs in material properties.

Chapter 1 – Introduction (cont)

Definitions:

- **material science:** The relationship between

_____.

- **material engineering:** Designing or engineering the structure of a material to

_____.

Chapter 1 – Introduction (cont)

Structure - The structure of a material can be classified based on dimensional scale:

- subatomic level
- atomic level
- microscopic level
- macroscopic level

Chapter 1 – Introduction (cont)

Property - The response elucidated from an applied external stimuli

Generally can be grouped into 6 categories

<u>category</u>	<u>response to</u>	<u>example properties</u>
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mechanical

electrical

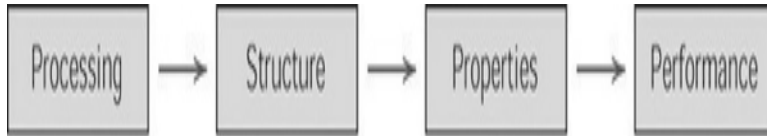
thermal

magnetic

optical

deteriorative

Chapter 1 – Introduction (cont.)



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Chapter 1 – Introduction (cont.)

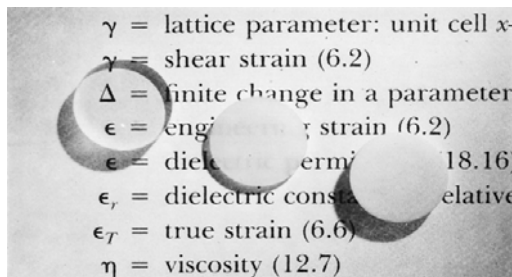


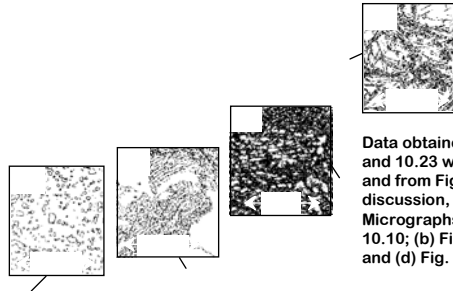
Figure 1.2

Same chemical composition, but different processing

- therefore - _____
- therefore - _____
- therefore - _____

Chapter 1 – Introduction (cont.)

- Properties depend on structure
ex: hardness vs structure of steel



- Processing can change structure
ex: structure vs cooling rate of steel

Chapter 1 – Introduction (cont.)

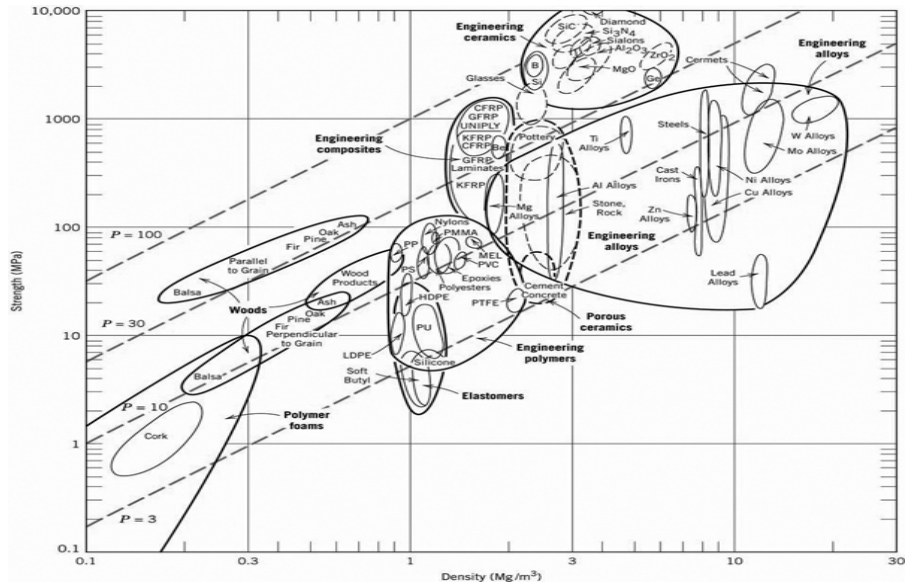
Tradeoffs

Materials rarely possess the ideal set of properties.
There are often tradeoffs.

Examples:

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-
-

Chapter 1 – Introduction (cont.)



Chapter 1 – Introduction (cont.)

Solid Material Categories

Solids are generally grouped into 3 categories

Metals

- Normally combinations of metallic elements
- Characterized by presence of _____
- Generally:
 -
 -
 -
 -

Chapter 1 – Introduction (cont.)

Solid Material Categories (cont.)

Ceramics

- Compounds with _____
(usually O, C, N)
- Characterized by _____ and _____
- Generally:
 -
 -
 -

Chapter 1 – Introduction (cont.)

Solid Material Categories (cont.)

Polymers (plastics and rubber materials)

- Characterized by _____
- Generally
 -
 -
 -

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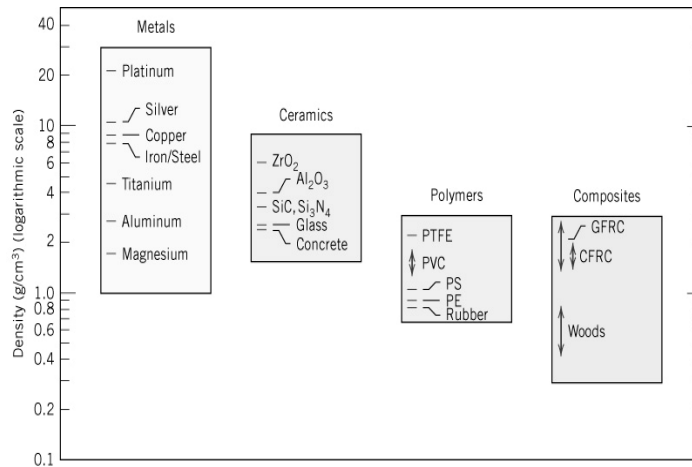


Figure 1.3

Chapter 1 – Introduction (cont.)

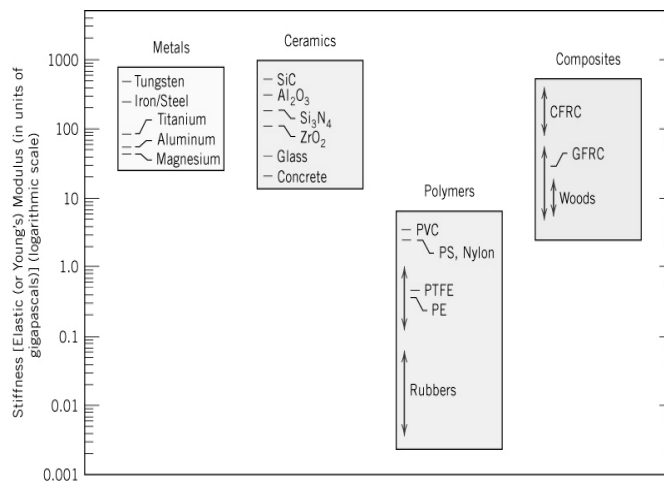


Figure 1.4

Chapter 1 – Introduction (cont.)

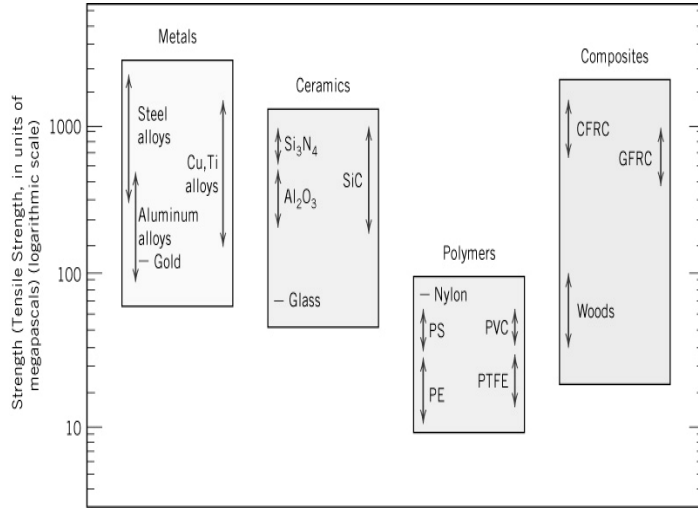


Figure 1.5

Chapter 1 – Introduction (cont.)

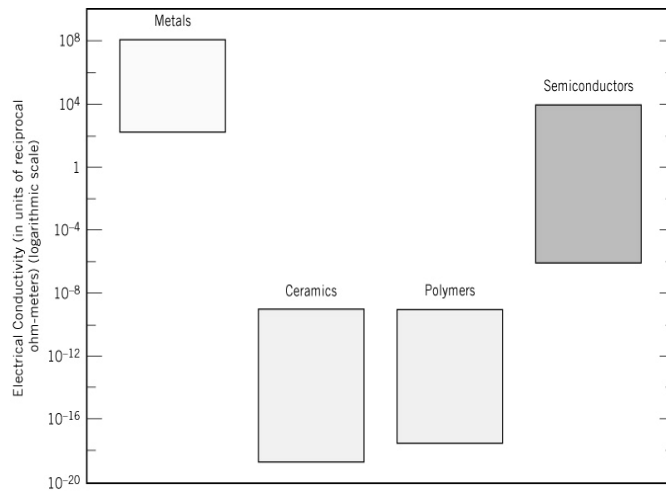


Figure 1.7