



Basics of Materials Science

Jan Ivens

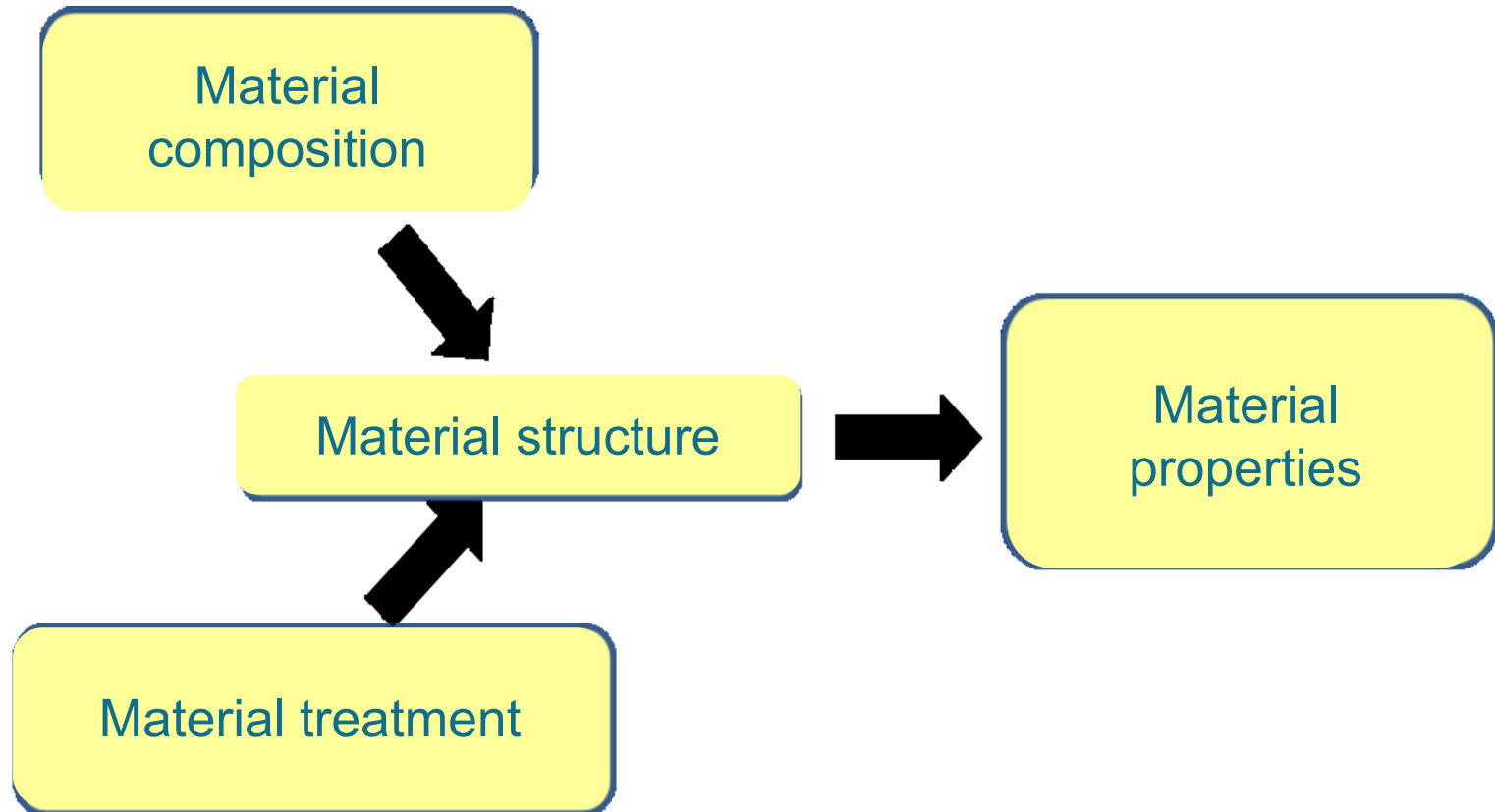
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Study contract

- 3 credits
- Evaluation:
 - Oral exam, closed book
 - Lab exam / report
- Course book
- Additional literature
 - Ashby: Materials: Engineering, Science, Processing and Design (2nd edition)
 - Jones & Ashby: Engineering Materials Volume 1, Second Edition

Course goal



Learning outcomes

Knowledge of:

- the different classes of materials (metals, polymers, ceramics and composites).
- Their principle properties
- the way in which the material composition and microstructure affects these properties

Ability to

- Apply this knowledge in a simple mechanical design problem
- Interpret data and/or test results in terms of material properties

Content

- Mechanical behaviour of materials : 14 hours
 - Stress, strain, stiffness
 - Time-independent behaviour: elastic behaviour, plastic behaviour
 - Time-dependent behaviour: creep, relaxation
 - Mechanical properties of the material classes
 - Testing of materials: tensile test, compression test, bending test, hardness
 - Failure of materials: ductile failure, buckling, brittle failure, fracture toughness and fracture toughness testing, fatigue

Content

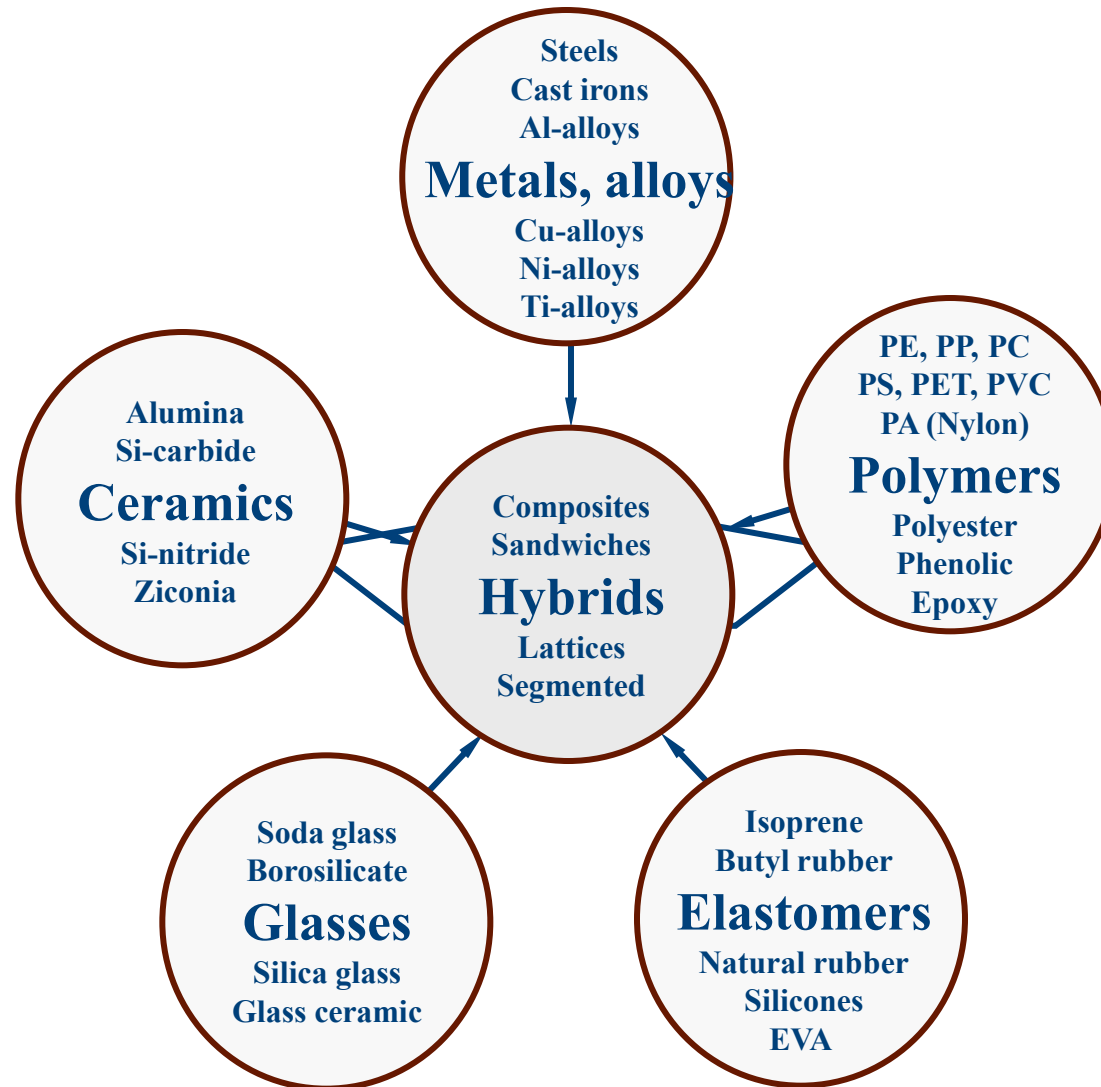
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Content- 2: Mechanical behaviour of materials

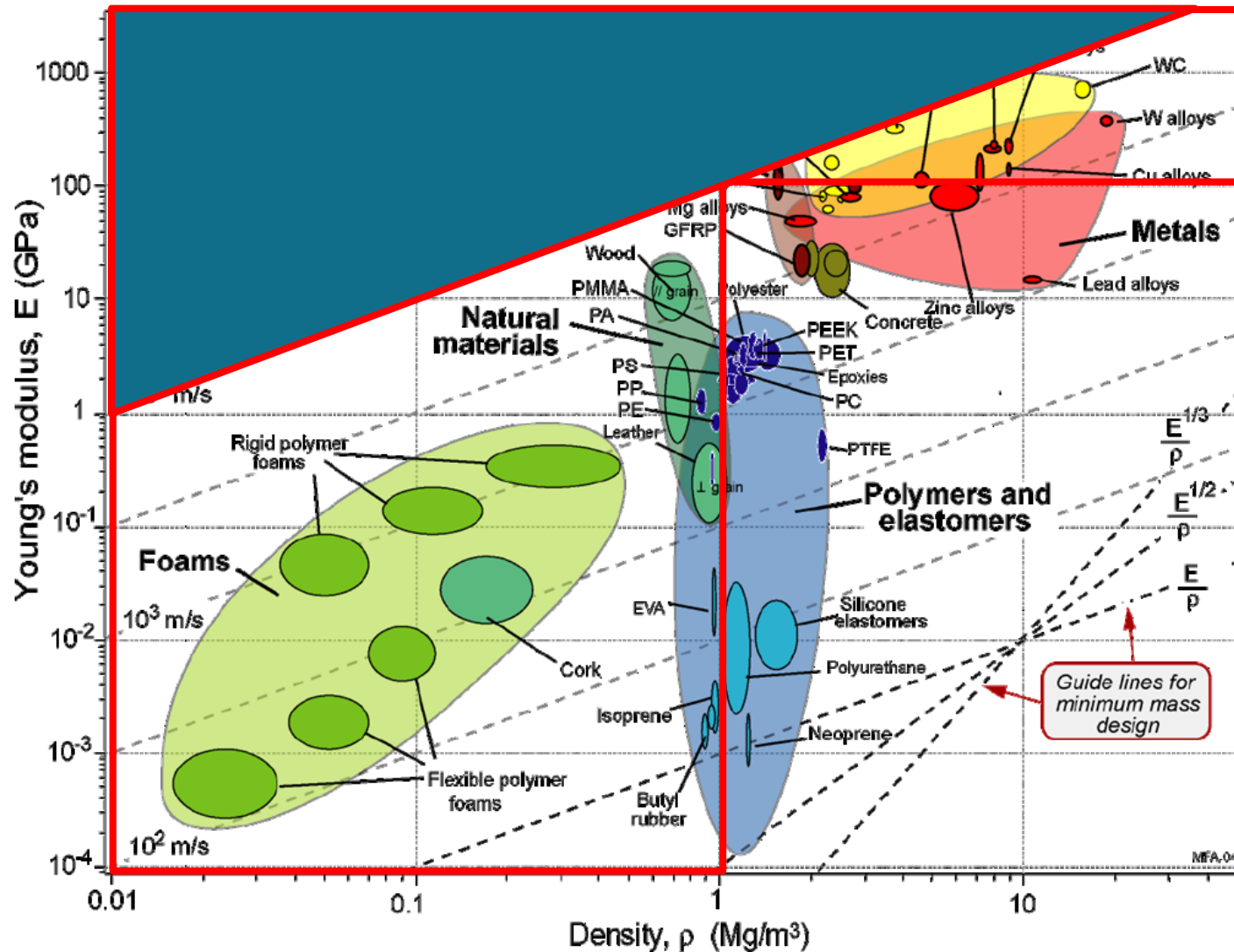
- Metals
- Ceramics
- Polymers
- Composites



Content-3: Introduction to materials selection

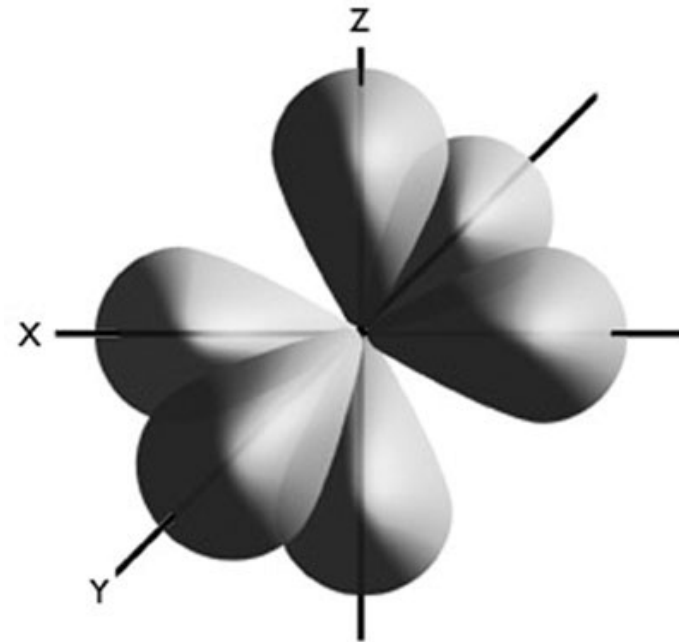


Example: stiffness and light-weight

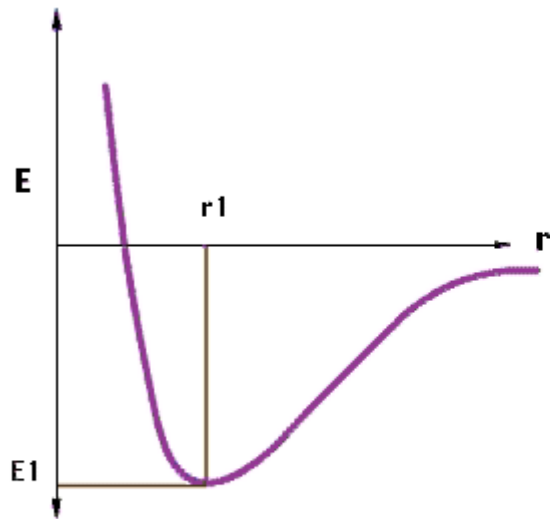
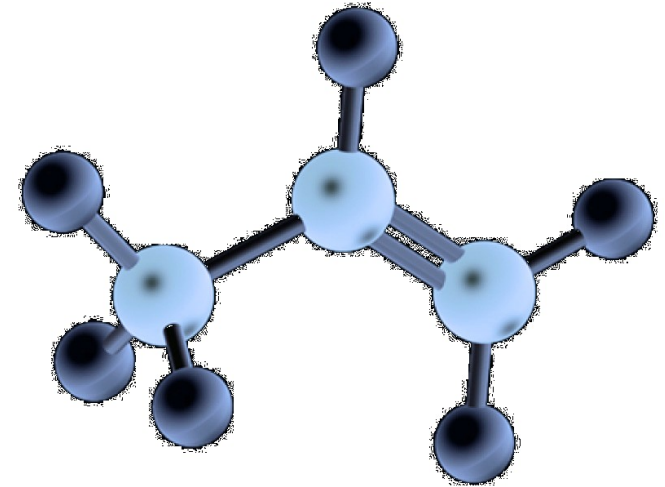
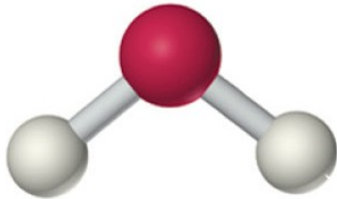


Multi-scale hierarchical structure of materials

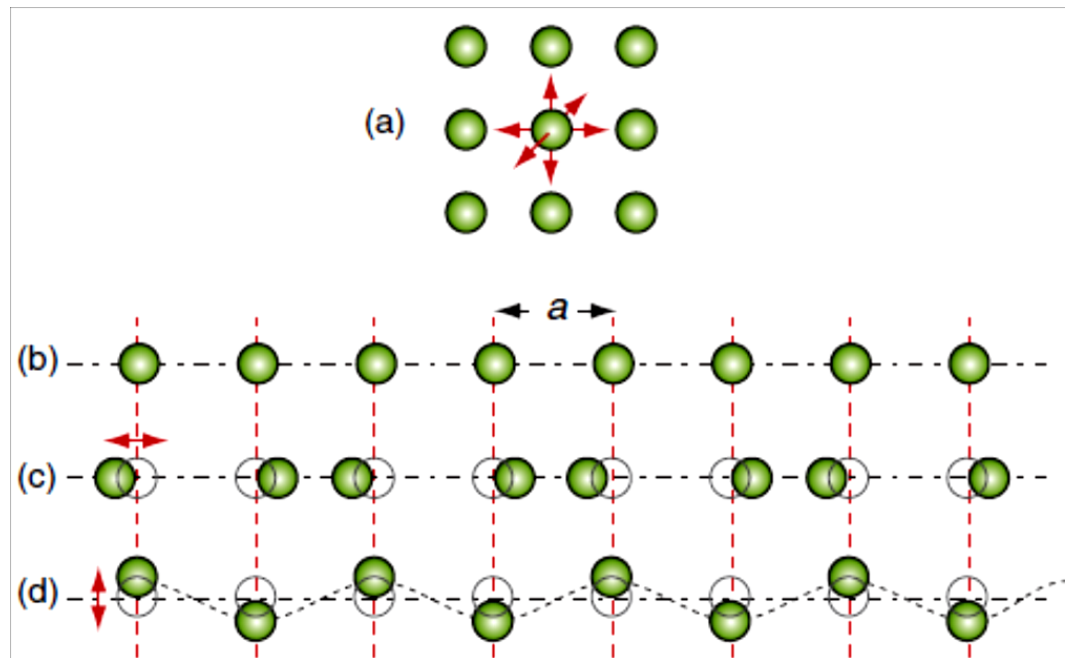
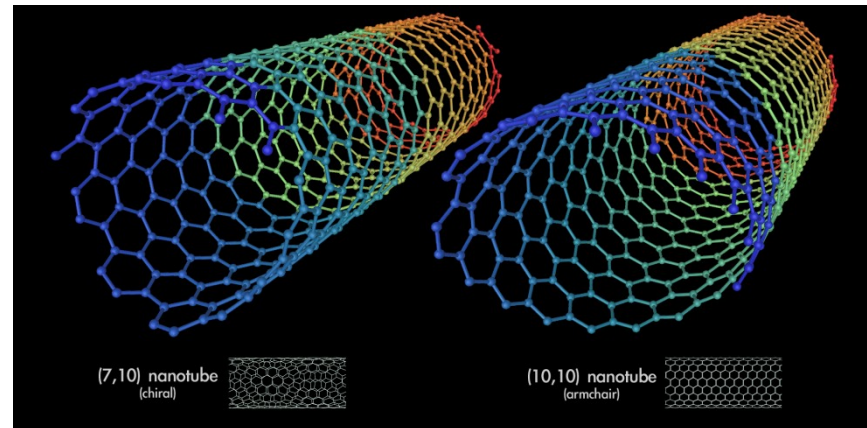
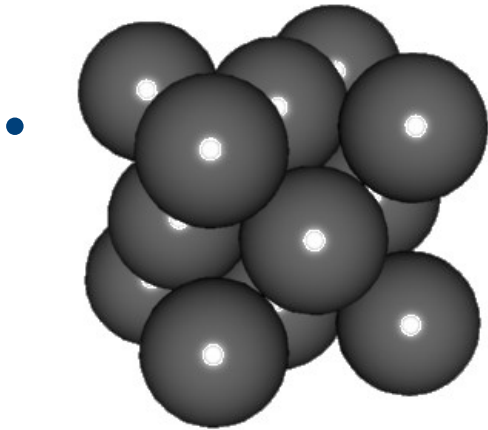
- Atomic level



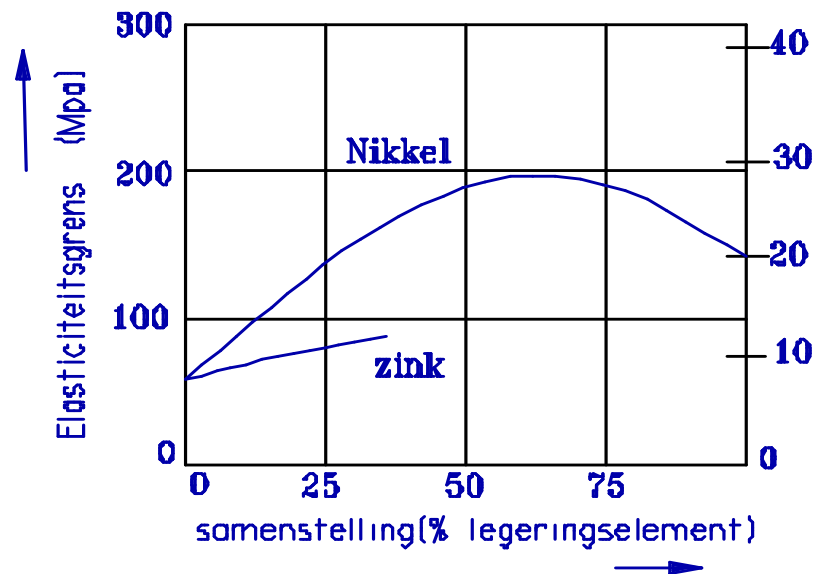
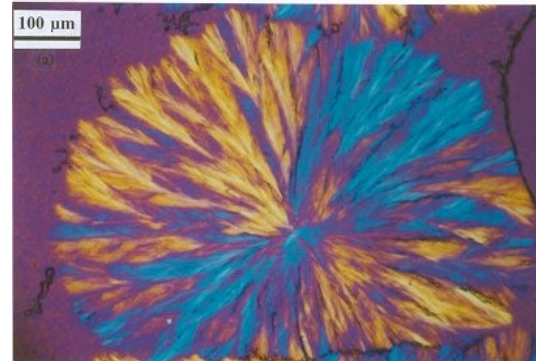
Bonds between atoms and molecules



Atomic and molecular ordering



microstructure



Meso-scale

