

# Fysik og Mekanik

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## Indhold

<b>1 Introduction to Materials Science</b>	<b>1</b>
1.1 Historical perspective . . . . .	1
1.2 Materials Science and engineering . . . . .	1
1.3 Classification and properties of materials . . . . .	2
1.4 Materials selection and Ashby diagrams . . . . .	2

## Lecture 1: Introduction to Materials Science

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This is all the course notes for the course Materials Science at Aarhus University taught by Michal Budzik & Narguess Nemati.

## 1 Introduction to Materials Science

### 1.1 Historical perspective

Materials development is a cornerstone in societal advancement. Many previous time-periods have even been classified based on the most “advanced” materials used in the period (think “the Stone Age”, “the Bronze Age”, “the Iron Age” and so on).

#### Eksempel 1.1: What (material) age are we living in now?

The by-far most prominent and tone-setting material in the current age is *plastics*. For this reason we believe the most correct name for the current material age is “the Plastic Age”.

Other answers include: *the Composite Age*, *still the Iron Age*, *the Composite age*, *the Lithium Age*, *the Bio-materials Age*, *the Concrete Age*, *the Titanium Age*, *the Silicon Age*, or *the Carbon Age*. Michal Budzik seems to agree the most with the *the Plastics Age* or *the Silicon Age*.

### 1.2 Materials Science and engineering

It is important to note the small difference between *Materials Science* and *Materials Engineering*, both of which will be taught about during the course.

#### Definition 1: Materials Science

Materials Science seeks to investigate relationships between structures and properties of materials with the goal of designing or developing new materials.

**Definition 2: Materials Engineering**

Materials Engineering seeks to create new product from existing materials with the goal of developing materials processing techniques among other things.

### 1.3 Classification and properties of materials

We normally divide materials into 4 different categories:

1. Metals
2. Ceramics
3. Polymers
4. Composites

In general the densities of the four classes are arranged as follows:  $\rho_m > \rho_{cer} > \rho_p > \rho_{com}$  whereas for stiffness the ranking is more like  $Y_m = Y_{cer} \geq Y_{com} > Y_p$ .

### 1.4 Materials selection and Ashby diagrams