

Introduction to Materials (Metals and Alloys)

Aim

This course aims to give students a thorough introduction to materials with a focus on metals and alloys and will cover the following topics:

1. Structure and properties of metals and alloys
2. Solidification and Phase Diagrams
3. Solid state transformations and TTT diagrams
4. Failure mechanisms: fracture, fatigue, creep

Learning Objectives

On completion of the course, the students will be expected to be able to:

1. Describe the structures of pure metals and alloys.
2. Interpret crystalline lattice distortion from given alloying elements and subsequent structural changes.
3. Describe the mechanical properties of metallic materials according to their structures.
4. Describe the differences between elastic, plastic, cold and hot deformation that can occur in metals.
5. Explain the effect of loading conditions and temperature on the mechanical properties of metallic materials.
6. Explain the differences between cracks and fractures comparing the mechanisms of different types of failures.
7. Assess types of failures.
8. Interpret the phase diagrams information and apply phase diagrams to define microstructures, mechanical properties and alloys.
9. Explain the principles of transformation and conditions of structure under which it occurs.
10. Explain the advantages and disadvantages of metals recrystallization, work hardening and strain ageing.
11. Compare the mechanisms of precipitation, types of precipitates and their location within the microstructure.

Instructors

- Adeayo Sotayo (Brunel University London) - AS
- Eujin Pei (Brunel University London) - EP
- Claes Fredriksson (Ansys Granta) - CF
- Alex Cazacu (Ansys Granta) - AC

Teaching Structure

Each session is two contact hours (2x50 minutes). The lectures will be delivered virtually via **Zoom**.

Week	Topic	Instructor
1a Monday 2 nd November 2020 2hr lecture	Introduction to materials	AS and CF
1b Thursday 5 th November 2020 2hr lecture	Mechanical Properties of Metals and Alloys	AS
2a Monday 9 th November 2020 2hr lecture	Phase Diagrams	CF
2b Thursday 12 th November 2020 2hr lecture	Phase Transformation	CF
3a Monday 16 th November 2020 2hr lecture	Strengthening of Metals and Alloys	AS
3b Thursday 19 th November 2020 2hr lecture	Fracture and Failure mechanisms of Metals and Alloys	AS
4a Monday 23 rd November 2020 2hr	Assessment (at the end of teaching)	AS
4B Thursday 26 th November 2020 2hr	Assessment week (at the end of teaching)	AS

Benefits

The course attendees will have an understanding of the structure, properties, phase diagrams and transformations, strengthening and failure mechanisms of Metals and Alloys. The lecture materials and handouts will be provided via email to registered attendees. Participants will also have temporary access to *GRANTA EduPack* software.