Introduction to Materials (Metals and Alloys)

<u>Aim</u>

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

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. Participans will also have temporary access to *GRANTA EduPack* software.