Lecture 1A

Introduction

Monday 2nd November 2020

Introduction to Materials (Metals and Alloys)

- This pilot course is organised under the scope of the **Sector Skills Strategy in Additive Manufacturing (SAM) Project**
- Running from 1st Jan 2019 – 31st Dec 2022
- European-wide consortium with 17 partners comprising:
  - Industries
  - Education and Training Providers
- Brunel University London – Work Package Leader

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Introduction to Materials (Metals and Alloys)

- This pilot course is organised under the scope of the **Sector Skills Strategy in Additive Manufacturing (SAM) Project**

- **<u>Some objectives of the SAM Project</u>**
  - Assess and anticipate skills (gaps and shortages) in AM;
  - Support with data the AM European Qualification System and foster wideness of its scope;
  - (Re)design professional profiles according to the industry requirements;
  - Develop specific relevant qualifications to be delivered for the AM Sector;
  - Increase the attractiveness of the sector to young people, whilst promoting gender balance;
  - Track students, trainees and job seekers and promote match making between job offer and search.

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Introduction to Materials (Metals and Alloys)

- **Sector Skills Strategy in Additive Manufacturing (SAM) Project**

Website: http://www.skills4am.eu/

Twitter: https://twitter.com/skills4am

YouTube: https://www.youtube.com/channel/UCO-PfDXv5ReiELtkvyVbtHA

Facebook: https://www.facebook.com/SectorSkillsStrategyinAdditiveManufacturing/

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Introduction to Materials (Metals and Alloys)

- **Sector Skills Strategy in Additive Manufacturing (SAM) Project**

SAM general group on LinkedIn:
https://www.linkedin.com/groups/12231279/

Students, Trainees & Jobseekers in AM
https://www.linkedin.com/groups/8918566/

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Meet your instructors

Dr Adeayo Sotayo

- BEng Mechanical Engineering, University of Liverpool, UK
- PhD Engineering, Lancaster University, UK
- Research Fellow and Associate Lecturer, University of Liverpool, UK
- **Research Fellow, Brunel University, UK**

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Meet your instructors

Dr Claes Fredriksson

- MSc and PhD in Physics at Linköping University, Sweden
- About 20 years teaching experience in materials (e.g. metals, polymers, composites) and sustainability, around the world
- **Associate Professor of Materials Science**
- **Lead Education Development Manager, Ansys Granta, UK**

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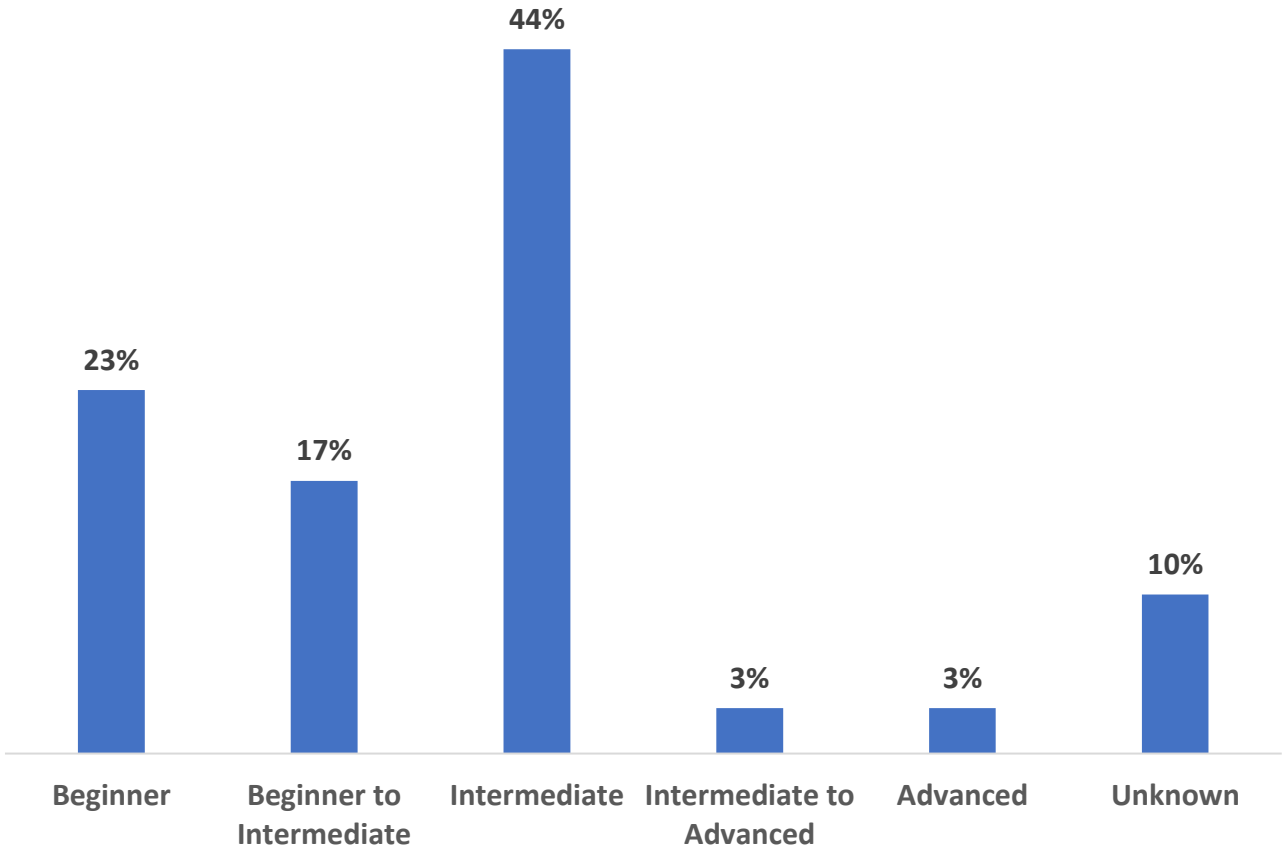
Participants' knowledge of Materials



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Quiz time – How are you feeling today and what country are joining us from?

Website – Sli.do

Enter – CU26

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Quiz time – What are your expectations and learning goals for this course?

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Enter – CU26

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Teaching structure

Week	Topic	Instructor
1A Monday 2nd November 2020 ***2hr lecture (10am – 12pm)***	**Introduction to Materials – Structures and Properties**	AS and CF
1B Thursday 5th November 2020 ***2hr lecture (10am – 12pm)***	**Mechanical Properties of Metals and Alloys**	AS
2A Monday 9th November 2020 ***2hr lecture (10am – 12pm)***	**Phase Diagrams and Microsctructures**	CF
2B Thursday 12th November 2020 ***2hr lecture (10am – 12pm)***	**Phase Transformations and TTT Diagrams**	CF
3A Monday 16th November 2020 ***2hr lecture (10am – 12pm)***	**Strengthening of Metals and Alloys**	AS
3B Thursday 19th November 2020 ***2hr lecture(10am – 12pm)***	**Fracture and Failure mechanisms of Metals and Alloys**	AS
4A Monday 23rd November 2020 ***2hr (10am – 12pm)***	**Summary and recap and QnAs**	AS and CF
4B Thursday 26th November 2020 ***2hr (10am – 12pm)***	**Assessment week**	AS

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Learning Outcomes

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.
12. *Knowledge of solidification and solid state transformations*

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Teaching Resources

- Lecture slides
- Granta EduPack (*Have you installed it?)*
- *<u>Further Reading</u>*
  - *Ashby, M.F., Jones, D.R. and Jones, D.R.H., 1994.* ***An introduction to microstructures, processing and design****. Pergamon Press.*
  - *Callister, W.D. and Rethwisch, D.G., 2018.* ***Materials science and engineering: an introduction****. New York: Wiley.*
  - *Callister Jr, W.D. and Rethwisch, D.G., 2020.* ***Fundamentals of materials science and engineering: an integrated approach****. John Wiley & Sons.*
  - *Mouritz, A.P., 2012.* ***Introduction to aerospace materials****. Elsevier.*
  - *Fischer, T., 2009.* ***Materials science for engineering students.*** *academic press.*

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Quiz time – Do you currently have access to Granta EduPack

Website – Sli.do

Enter – CU26

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Assessment

- At the end of the course, participants will need to complete the assessment for this course, which are based on:
  - Learning outcomes
  - Lecture slides
  - Other teaching resources (shared).
- Participants must attend the lectures and get a **minimum of 60%** in the assessment to be eligible for the **certificate of attendance** by the **SAM project**.

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Any Questions ???

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