

# Aluminium Metallurgy Structure & Surface Essentials.

This course contains the following modules:

## Introduction to Aluminium.

- Aluminium production and usage
- Overview of alloy systems and applications
- Common manufacturing methods

## Aluminium Microstructure & Metallurgy Fundamentals.

- Aluminium crystal structure, alloy systems and phase diagrams
- Casting and solidification microstructures
- Strengthening Mechanisms
- Microstructure evolution during processing

## Testing & Materials Characterisation.

- Chemical composition
- Mechanical properties and formability
- Microstructure: intermetallic particles, grain structure and texture
- Fractography and failure analysis

## Testing & Materials Characterisation Workshop.

- Case-study on characterisation of cast aluminium
- Hands-on introduction to sample preparation and optical microscopy
- Grain size assessment (including sample anodizing and recommendations for data processing)
- Scanning electron microscopy of secondary phases in the microstructure.

## Thermal Treatments.

- Homogenisation and preheat
- Solution heat treatment
- Artificial ageing

## Thermal Treatments Workshop.

- Follow-on from the case-study of the cast aluminium
- Defining a homogenization cycle and applying to the material
- Differential scanning calorimetry to assess the effectiveness of the heat treatment

### **Deformation and Annealing Mechanisms.**

- Deformation and microstructure
- Recovery and recrystallisation
- Control of grain structure

### **Deformation and Annealing Workshop.**

- Follow-on from the case-study of the homogenized aluminium – after mechanical processing.
- Assessment of mechanical properties using the Instron Loadframe.
- Hands-on practical assessment of the changes to the microstructure using optical microscopy and scanning electron microscopy.

### **Aluminium surfaces.**

- Surface characteristics
- Surface generation during processing
- Factors affecting surface properties
- Quality requirements and inspection
- Common product defects

### **Surface cleaning.**

- Objectives of surface cleaning
- Cleaning types and reaction mechanisms
- Critical control parameters in production
- Evaluation of surface cleanliness
- Common issues and remedies

### **Surface pretreatment.**

- Typical requirements
- Pretreatment developments
- Formation mechanisms
- Automotive pretreatments
- Application techniques

### **Anodising.**

- Purpose of anodising
- Mechanism of anodising
- Influence of processing parameters
- Anodising types and applications
- Common issues and remedies

### **Surface coating.**

- General characteristics
- Adhesion properties
- Coating chemistry
- Performance testing
- Coating modifications

### **Surfaces Workshops.**





























- Case study of surface defects on aluminium sheet
- Hands on experience on various surface related characterisation techniques, including surface roughness, FTIR surface chemistry and oxide thickness analysis, optical microscopy and low kV SEM, etc.
- Case study learning on how to identify root cause of surface defects.

### **Q&A Session.**


- Interactive session with Innoval's experts
- Wrap-up


## Sample Agenda

## Aluminium Metallurgy Structure & Surface Essentials.

| Day 1             |  | Day 2             |  | Day 3             |  |
|-------------------|--|-------------------|--|-------------------|--|
| 09:00 - 17:00 GMT |  | 09:00 - 17:00 GMT |  | 09:00 - 17:00 GMT |  |
| 09:00             | Introduction   | 09:00             | Thermal treatments 2 (Solution Heat Treatment)  | 09:00             | Surface cleaning 2                    |
| 10:00             | Microstructure & metallurgy fundamentals 1  | 10:00             | Thermal treatments 3 (Artificial Aging)         | 10:00             | Surface defect case study workshop 1  |
| 10:45             | Break                                       | 10:45             | Break   | 10:45             | Break                                 |
| 11:00             | Testing and characterisation                | 11:00             | Thermal treatments workshop                     | 11:00             | Surface pre-treatment                 |
| 11:15             | Break                                       | 12:00             | Lunch   | 12:00             | Lunch                                 |
| 12:00             | Testing and characterisation workshop 1     | 13:00             | Defomation & annealing mechanisms               | 13:00             | Anodising                             |
| 13:00             | Lunch                                       | 14:00             | Deformation and annealing workshop              | 14:00             | Surface defect case study workshop 1  |
| 14:00             | Microstructure & metallurgy fundamentals 2  | 14:45             | Break   | 14:45             | Break                                 |
| 15:00             | Testing and characterisation workshop 2     | 15:00             | Aluminium surfaces                            | 15:00             | Surface coating                     |
| 15:45             | Break                                     | 16:00             | Surface cleaning 1                            | 16:00             | Final Q&A and wrap-up  |

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