INNOVAL

# Aluminium Rolling Technology Course [Online].

This course contains the following modules:

### Aluminium Market Dynamics & Drivers.

- Economics of rolling
- Business cycles
- Future trends

### Aluminium Casting Overview.

- Outline of the process routes continuous casting and direct chill casting
- Metal conditions at various stages during casting
- Machinery used in casting

### Process & Machinery Overview.

- Outline of Aluminium process routes
- Major components of reversing and hot mills, tandem mills and cold mills
- Outline of machinery used
- Types of actuator in rolling mills

### Mechanics of Rolling.

- Yield criteria
- Friction hill
- Factors determining rolling load
- Closed and open gap rolling
- Attenuation

### Finishing Overview.

- Outline of finishing line process routes
- Outline of machinery used
- Affects of processing on product quality

### Process Metallurgy.

- Alloy choice
- Microstructure
- Strengthening mechanisms
- Annealing

### Thermal Aspects of Rolling.

- Heat sources and sinks
- Temperature distributions in rolls and strip
- Design of roll spray cooling systems
- Strip cooling

### Tribology in Aluminium Rolling.

- Friction and lubrication basic principles
- Interaction of rough surfaces
- Role of additives
- Hot and cold rolling oils
- System maintenance
- Filtration

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### Mechanics of Profile & Flatness.

- Definitions of profile and flatness
- Sources of variation
- In-process specification and targets for control

### Surface Generation & Surface Defects.

- Surface generation during rolling
- Oil entrapment
- Strip brightness control
- Scuffing
- Types of defect
- Reduction marks
- Surface inspection

### Data Workshop.

- Introduction of data analysis and IBA software
- How to interpret rolling mill data and create meaningful templates

### Introduction to Control.

- Open and closed loop control systems
- PID control and gain determination
- Ziegler-Nichols testing
- Use of feedback

### Mill Vibration.

- Sources of vibration in cold mills
- Vibration modes
- Mechanical defects & vibration

### Automatic Gauge Control.

- Total gauge description
- Gauge control loops
- Measurement devices
- Different methods of gauge control in current use

### Measurement & Control of Profile.

- Measurement of profile
- Actuators for control
- An integrated control strategy
- Scheduling, setup, adapted setup & in-coil strategies

### Automatic Flatness Control.

- Definition
- I-units
- Different types of off-flatness
- Relation with stress
- On-line measurement
- Flatness control actuators
- Strategies to control flatness

### Wrap-up and Q&A Session.

- Interactive session with Innoval's experts
- Wrap-up of the week

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**Sample Agenda**

## Aluminium Rolling Technology Course [Online]: Week 1

| Week 1: Mon | 09:00 - 12:45 |
|---|---|
| 09:00 | Introduction |
| 09:45 | Aluminium Market Dynamics & Drivers |
| 10:30 | Break |
| 10:45 | Aluminium Casting Overview |
| 11:30 | Break |
| 11:45 | Process & Machinery Overview |
| 12:30 | Group Discussion and Q&A |

| Week 1: Tue | 09:00 - 12:45 |
|---|---|
| 09:00 | Process & Machinery Overview |
| 10:00 | Break |
| 10:15 | Mechanics of Rolling |
| 11:30 | Break |
| 11:45 | Mechanics of Rolling Tutorial |
| 12:30 | Group Discussion and Q&A |

| Week 1: Wed | 09:00 - 12:45 |
|---|---|
| 09:00 | Finishing Overview |
| 09:45 | Break |
| 10:00 | Process Metallurgy |
| 11:00 | Break |
| 11:15 | Process Metallurgy Tutorial |
| 11:45 | Process Metallurgy |
| 12:30 | Group Discussion and Q&A |

| Week 1: Thu | 09:00 - 12:45 |
|---|---|
| 09:00 | Thermal Aspects of Rolling |
| 10:00 | Break |
| 10:45 | Thermal Aspects of Rolling |
| 11:15 | Break |
| 11:30 | Thermal Aspects of Rolling Tutorial |
| 12:30 | Group Discussion and Q&A |

| Week 1: Fri | 09:00 - 12:45 |
|---|---|
| 09:00 | Tribology in Aluminium Rolling |
| 10:15 | Break |
| 10:30 | Mechanics of Profile and Flatness |
| 11:15 | Break |
| 11:30 | Mechanics of Profile and Flatness |
| 12:30 | Group Discussion and Q&A |

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## Aluminium Rolling Technology Course [Online]: Week 2

| Week 2: Mon | 09:00 - 12:45 |
|---|---|
| 09:00 | Surface Generation |
| 10:00 | Break |
| 10:15 | Surface Defects |
| 11:15 | Break |
| 11:30 | Data Tutorial |
| 12:30 | Group Discussion and Q&A |

| Week 2: Tue | 09:00 - 12:45 |
|---|---|
| 09:00 | Introduction to Control |
| 10:00 | Break |
| 10:15 | Control Tutorial |
| 10:45 | Mill Vibration |
| 11:30 | Break |
| 11:45 | Mill Vibration |
| 12:30 | Group Discussion and Q&A |

| Week 2: Wed | 09:00 - 12:45 |
|---|---|
| 09:00 | Automatic Gauge Control |
| 10:00 | Break |
| 10:15 | Automatic Gauge Control Tutorial |
| 11:30 | Break |
| 11:45 | Automatic Gauge Control |
| 12:30 | Group Discussion and Q&A |

| Week 2: Thu | 09:00 - 12:45 |
|---|---|
| 09:00 | Measurement and Control of Profile |
| 10:00 | Break |
| 10:15 | Measurement and Control of Profile |
| 11:15 | Break |
| 11:30 | Measurement and Control of Profile Tutorial |
| 12:30 | Group Discussion and Q&A |

| Week 2: Fri | 09:00 - 12:45 |
|---|---|
| 09:00 | Automatic Flatness Control |
| 10:00 | Break |
| 10:15 | Automatic Flatness Control Tutorial |
| 11:00 | Break |
| 11:15 | Automatic Flatness Control |
| 12:30 | Group Discussion and Q&A |

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