Aluminium Rolling Technology

This course contains the following modules:

The Business of Rolling
• Economics of rolling
• Business cycles
• Future trends

Outline of the Sheet Rolling Process
• Outline of the process routes and metal conditions at various stages from cast ingot to coil

Process Metallurgy
• Alloy choice
• Microstructure
• Strengthening mechanisms
• Annealing

Mechanics of Rolling
• Yield criteria
• Friction hill
• Factors determining rolling load
• Closed and open gap rolling
• Attenuation

The Machinery of Rolling
• Types of roll stacks
• Major components of reversing and hot tandem mills
• Cold mills
• Special actuators: VC, CVC, DSR, 6hi
Thermal Aspects of Rolling
• Heat sources and sinks
• Temperature distributions in rolls and strip
• Design of roll spray cooling systems
• Strip cooling

Mechanics of Profile & Flatness
• Definitions of profile and flatness
• Sources of variation
• In-process specification and targets for control

Introduction to the Innoval Rolling Model
• Process simulation of hot and cold rolling using a physics-based model

Aluminium Rolling Lubrication
• Friction and lubrication basic principles
• Interaction of rough surfaces
• Role of additives
• Hot and cold rolling oils
• System maintenance
• Filtration

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

Introduction to Control
• Open and closed loop control systems
• PID control and gain determination
• Ziegler-Nichols testing
• Use of feedback
Profile Measurement and Control
• Measurement of profile
• Actuators for control
• An integrated control strategy
• Scheduling, setup, adapted setup & in-coil strategies

Automatic Gauge Control
• Total gauge description
• Gauge control loops
• Measurement devices
• Different methods of gauge control in current use

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

Rolling Mill Vibration
• Main types of mill vibration
• Torsional, 3rd and 5th octave chatter
• Resonance modes of mills
• Self excitation
• Examples of solutions to vibration problems

Condition Monitoring
• Maintenance strategies: reactive, preventive and predictive
• Reliability-centred maintenance
• Vibration detection
• Thermography and wear analysis

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