This three-day training course covers melting of aluminium, the development of aluminium molten metal treatments designed to improve metal quality, and the technology of the DC casting process for slabs and billets.

A fresh approach

Many technical training courses start from basic principles, building towards a detailed analysis of the particular technology. This often leaves attendees floundering in a sea of concepts and equations, unsure how the physical basics relate to the actual work place.

Our approach, based on extensive experience in delivering training courses to industry, overcomes these difficulties. We first provide an appreciation of what the various technologies are expected to deliver to their customers, and why it is important. Only then do we consider how everyday operations relate to the physical basics.

Most importantly we use hands-on workshops extensively, where attendees investigate the relationships between actuators they control (e.g. gas flow rate, casting temperature) and the performance of each manufacturing stage. Some are computer based, and some involve physical experiments.

Such ‘discovery-based learning’ results in a deeper understanding, and better knowledge retention and usage in the workplace.

‘I should have done this ten years ago – it was very helpful, and the workshops gave it a practical relevance’

Course structure

The course focuses on
- melting, alloying and mixing
- melt loss, dross formation and control
- decoating
- molten metal quality and metal treatment
- principles of DC casting technology
- sheet ingot and billet casting
- heat transfer and water quality.

The series of seminars is interspersed with frequent hands-on workshops.

Furnaces, melting and melt loss

The key metrics for a melting furnace of melt rate, energy efficiency and melt loss are introduced, and understood in terms of heat transfer principles and oxidation kinetics. The applicability of dry hearth or submerged melting practices to different charge formats is discussed. Net and gross melt loss are defined and related to dross formation. The importance of scrap decoating to reduce melt loss is explained, and in particular the critical role of the decoating process gas and its chemistry is demonstrated.

‘Great course, there was something even for remelt personnel with lots of experience’
Course structure (cont.)

Molten Metal Treatments
The key quality measures of molten aluminium are introduced: hydrogen content, non-metallic inclusions and alkali metals. For each in turn, the problems encountered when their respective concentrations reach too high a level are reviewed, both in the cast operation, but also during downstream processing. This is followed by a comparison of the various measurement technologies available. Finally, the options for active control are discussed, and the scientific basis explained.

The technology of DC casting
The major elements of DC casting are introduced and their significance explained. The geometries of DC ingots and billets are considered, in terms of shell depth, sumps, rolling face pull-in, and butt bulge and curl. Relationships between these features and the process variables are described. The upstream conduction distance is explained, and used to design casting practices, focussing on low head casting, and pressure-assisted casting. Heat transfer concepts are introduced, in terms of the macroscopic heat extraction from the ingot, and then related to surface heat flux and the effects of water quality. Simple analytical treatments are provided, relating key ingot metrics, such as shell depth and sump depth to casting parameters and material constants.

Workshops
‘The structure and presentation were excellent, but the workshops were the icing on the cake’

This open course, with attendees from many companies, is regularly run by tsc. Each attendee is provided with a full copy of the lecture and workshop material, as hard copy and on a CD-ROM.

Presenters
Paul Evans and Ricky Ricks were formerly directors of research and innovation for Alcan. They set up tsc to help clients develop their technology strategy, including training, knowledge management, technology development and competitive intelligence.

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