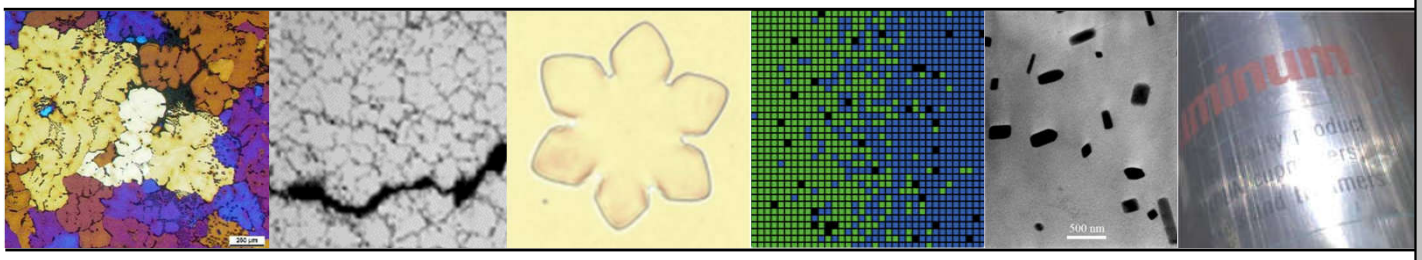
The Metallurgy of Aluminium Solidification and Homogenisation

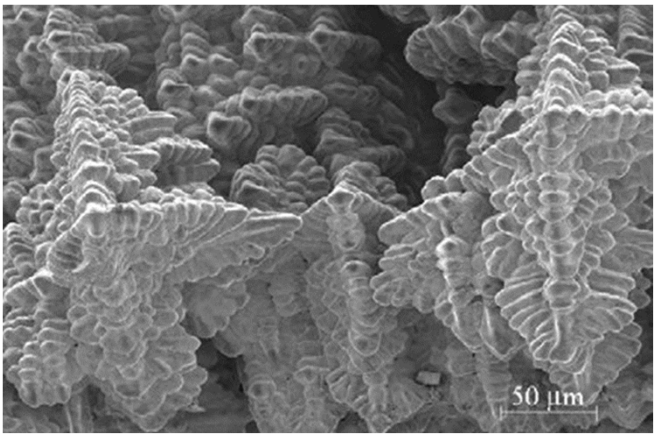
Weekly Live Online Course

This online training course is presented over 10 weekly sessions. It introduces the basic principles of physical metallurgy: relationships between processing and microstructure, and microstructure and properties. It introduces the microscopy tools required to understand microstructures. The course covers nucleation, dendritic growth, partitioning and intermetallic formation in casting, and then explores microstructural evolution during homogenisation.



Why Metallurgy?

Aluminium plants often employ fewer qualified metallurgists than they did in the past. This is partly because many universities are no longer teaching metallurgy, and those that do treat it as a sub-set of materials science. And within that sub-set, precious little time, if any, is devoted to aluminium metallurgy.



At *tsc* we firmly believe that technical staff involved in the production of wrought aluminium products need a good grounding in aluminium physical metallurgy. The response of an alloy to processing, and the properties of the final products, are the domain of physical metallurgy. Problems encountered in production are usually solved more efficiently when approached from a position of knowledge, rather than treating the system as a "black box" about which we know nothing. The understanding of aluminium physical metallurgy has been developed over the last century: this course provides a good foundation in this discipline.

The microstructure of a wrought product evolves throughout the process stream, but the journey starts with solidification and homogenisation, which is the focus of this course.

Course Structure

- metallurgical principles relating processing to microstructure, and microstructure to properties
- aluminium phase diagrams and their usage
- solidification mechanisms and growth forms
- microstructural evolution during homogenisation

Each weekly session is centred on a seminar delivered live, allowing hand-raising and discussion.

Following the seminar, a related workshop is introduced, which attendees tackle in their own time. This workshop is reviewed interactively at the start of the next live session.

Agenda

1. Introduction to metallurgy and microstructure
2. Basic phase diagrams
3. Aluminium phase diagrams
4. Solidification (1): grains
5. Solidification (2): dendrites
6. Solidification (3): eutectics
7. Homogenisation (1): solute equilibration
8. Homogenisation (2): dispersoid formation
9. Homogenisation (3): intermetallics
10. Downstream effects of solidification and homogenisation

"Been on almost all aluminium training courses from TSC. Content is current, relevant and expertly put together. Practical workshops at the end of each session bring theory and real world problems together. I can recommend the TSC courses for every specialist working in the aluminium industry."
Francois Vlok, Hulamin Rolled Products

tsc Training Courses: *The Metallurgy of Solidification & Homogenisation*

Technology Strategy Consultants
www.tecstrat.com

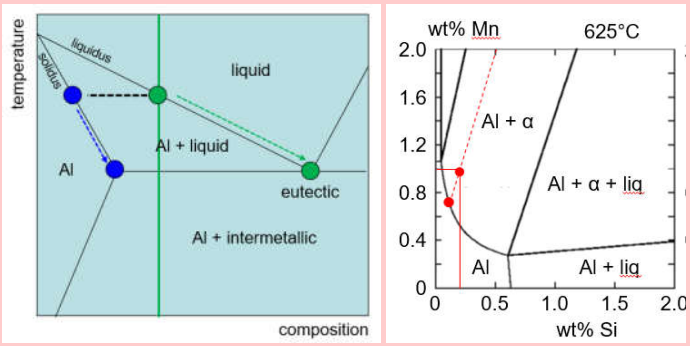
The Metallurgy of Aluminium Solidification and Homogenisation

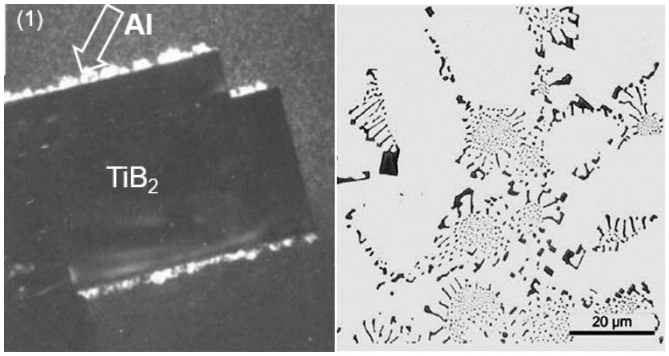
Course Structure

"Thanks guys. Excellent content, very well presented in a professional, pedagogical manner with a constant touch of funny! See you next time!"
Yves Larouche, Dynamic Concept

Phase Diagrams

The information provided in a phase diagram is explored using salt-water as a model system, before applying the understanding to aluminium binary and ternary systems. The implications of partitioning are explained, leading to microsegregation patterns across dendrites, and the inevitable formation of constituent intermetallic compounds via a eutectic reaction in all iron containing commercial alloys.



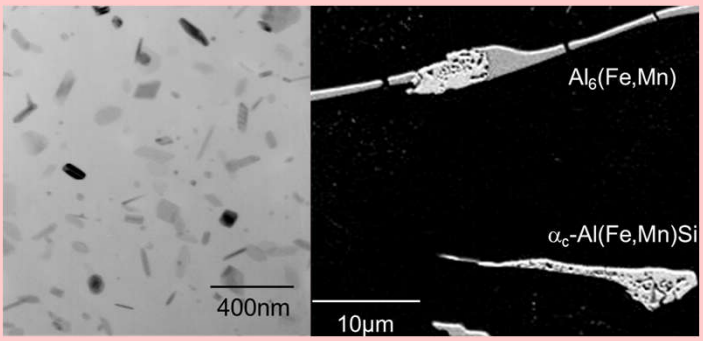


Solidification

The barrier to homogeneous nucleation is explained, leading to the need for grain refinement in commercial aluminium alloys. The significance of grain refinement is demonstrated, as a means to improve castability. The ubiquitous dendritic growth form is analysed in terms of interface stability. The concept of coupled growth is explored in the context of regular and irregular eutectics.

Homogenisation

The kinetics of diffusion are analysed, and the common solutes categorized as fast or slow diffusers. A series of diffusion controlled processes are analysed. For fast diffusers, solute equilibration across a dendrite is possible during homogenisation. For slow diffusers, local equilibrium is achieved by dispersoid formation. Cast intermetallic phases may be soluble, or may undergo a phase transformation.



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 knowledge management and technical training.

Mike Shirran is an industrial aluminium metallurgist with extensive experience of process and product metallurgy. He has worked as R&D manager, and is now as a consultant to the global aluminium industry.

Registration

Register online : **www.training.tecstrat.com**

Contact us for further information:

equiries@tecstrat.com

"It was refreshing to attend this very professional metallurgy course regarding aluminium and its alloys during solidification and homogenization. Back to the period of being a student! But this time, Paul taught us the microstructure and metallurgical background of what we master macroscopically."
Ria Van den Broeck, Aluminium Duffel

Technology Strategy Consultants
Unit 30 Alfred Groves Business Park,
Shipton Rd., Milton-under-Wychwood, Oxfordshire
OX7 6JP, UK

tel: **+44 (0) 1993 832130**
email: **enquiries@tecstrat.com**
website: **www.tecstrat.com**

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