JÖNKÖPING UNIVERSITY
School of Engineering

COURSE SYLLABUS

Liquid Metal Processing, 7.5 credits

Smältning och stelningsprocesser, 7.5 högskolepoäng

Course Code:	T2SOSQ	Education Cycle:	Second-cycle level
Confirmed:	Sep 01, 2025	Disciplinary domain:	Technology
Valid From:	Aug 31, 2026	Subject group:	Materials Technology
		Specialised in:	A1N Second cycle, has only first-cycle course/s as entry requirements
		Main field of study:	Product Development

Intended Learning Outcomes (ILO)

On completion of the course the student shall:

Knowledge and understanding

- display knowledge of the common impurities and tramp elements in aluminium melt and their removal for a sustainable circular material recycling
- demonstrate comprehension of the industrial treatments and quality assessment of aluminium alloy melts
- display a fundamental understanding of microstructure development during solidification
- demonstrate comprehension of microstructural control and management through composition, cooling rate and treatment

Skills and abilities

- demonstrate the ability to select a suitable treatment and casting process for a specific aluminium alloy using thermodynamics and kinetics for the intended reactions and process steps
- demonstrate the ability to calculate and discuss in detail the formation of various solidification microstructures in relation to the phase diagram

Judgement and approach

- demonstrate the ability to assess the liquid and solidification treatment according to the required outcome
- demonstrate the ability to suggest methods to improve the microstructure and performance of cast metals

Content

The critical content is related to preparing aluminium alloys, including light metal scrap recycling technologies, melt refining, and impurity control to enable the sustainable management of circular materials. The fundamental mechanisms of solidification and different conditions for the formation of microstructure during solidification and casting defects will be taught. Finally, microstructural engineering, such as grain refinement and microstructural modification for desired properties, will be discussed.

The course includes the following elements:

- The effect of dissolved impurities and inclusions on the mechanical properties of metal products
- Thermodynamics and transport properties relevant for the removal of dissolved elements and inclusions from molten metals and the addition of alloying elements
- Industrial melt management practice for aluminium alloys and sustainable circular materials management

- Solidification and microstructural control formation through homogeneous and heterogeneous nucleation for grain refinement
- Primary phase growth and morphological control with Interface stability and constitutional undercooling and modification
- Multiphase reactions such as eutectics and peritectic
- Mushy zone characteristics and their importance for casting defect formation
- Practical melting, melt treatment and casting laboration
- Industrial case studies as a group assignment

Type of instruction

Lectures, assignments (individual and in group) and laboration.

Language of instruction is English.

Entry requirements

The applicant must hold the minimum of a bachelor's degree (i.e the equivalent of 180 ECTS credits at an accredited university) with at least 90 credits in Materials and Manufacturing, Materials Engineering, Mechanical Engineering, Chemical Engineering, Product Development or Engineering Physics or equivalent. The bachelor's degree should comprise a minimum of 15 credits in Mathematics. Proof of English proficiency is required.

Examination and grades

The course is graded 5, 4, 3 or U.

Registration of examination:

Name of the Test	Value	Grading
Assignment	3.5 credits	G/U
Laboratory	1 credit	G/U
Examination	3 credits	5/4/3/U

Course literature

Please note that changes may be made to the reading list up until eight weeks before the start of the course.

1. Liquid Metal Processing Anders E. W. Jarfors
2. Phase Transformations in Metals and Alloys, 3rd edition, David A. Porter, Kenneth E. Easterling, and Mohammed Y. Sherif (Chapter 4)