

Casting Processing, MH2252, 6hp H19

Goals

The aim of the course is to give insight in and knowledge of the problems arising during casting of metals and understanding how the processes can be controlled to minimize errors and maximize yield. The course gives an overview of both component casting and cast house processes such as ingot casting, continuous casting and direct casting

Content

After completing the course the student will have knowledge of:

- Solidification processes (thermal conductivity).
- Structure formation.
- Influence of shrinkage on solidification processes as pipe formation in ingots.
- Formation of macro- and micro segregation.
- Precipitation of secondary phases during solidification.
- Structural changes at heating, forming and homogenisation.
- Metallic melts properties related to casting properties.
- Solubility of gases in melts and precipitation of gas during solidification.
- Forced and natural convection at casting and solidification.
- Surface tension gas/liquid and its importance in casting processes.
- Nucleation and inoculation in melts.
- Analytical and numerical modelling of solidification and casting processes.
- Thermal stresses and crack formation at casting of metals.
- Process control and optimization of casting processes.

Eligibility

A BSc degree within Materials science and engineering or equivalent (180 credits).

Literature

Materials Processing during Casting. Hasse Fredriksson, Ulla Åkerlind, Wiley, March 2006, ISBN: 0-470-01514-4. Freely available by Wiley Online Library accessed by KTH Library.

Examination

LAB1 – Study visit, 0.7 credits, grade scale: P, F

TEN1 - Examination, 3.8 credits, grade scale: A, B, C, D, E, FX, F

ÖVN1 - Assignment, 1.5 credits, grade scale: P, F

Requirements for final grade:

Written examination (TEN1), Computer assignment (ÖVN1), Lab work and study visit (LAB1)

Examiner:

Anders Eliasson 08-790 7255 <u>anderse@kth.se</u>

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E-post anderse@kth.se

Lectures and exercises

The aim of the lectures in the course is to highlight the vital parts of the course. The major part of the material is to be studied individually.

Lecturer: Anders Eliasson, anderse@kth.se

The exercises will give opportunity to discuss application of theory and to solve problems.

Problem solving will be done both by the students and by the assistant.

Assistant: Lu Yu-Chiao (Ishana), yclu@kth.se

Computer assignment (Övn1: 1,5 credits)

A computer assignment should be solved by help of the numerical simulation program MagmaSoft.

Assistant: Nils Andersson <u>nilsande@kth.se</u>

Laboration – experimental work

Assistant: Nils Andersson nilsande@kth.se

Study visit (Lab1: 0,7 credits)

A mandatory study visit is planned to a foundry. For H19 it will be towards the Scania foundry and the metal research department. The students are requested to in groups prepare questions, write a visit report and present it at a seminar.

Responsible: Anders Eliasson, anderse@kth.se

Isak Hollinger, isak.hollinger@scania.com, Jessica Elfsberg, jessica.elfsberg@scania.com

Examination (Ten1: 3,8 credits)

The examination is in two parts. The first part is answered without any aid, while during the second part the use of handed out course material (Summary pages) is allowed. Note, this means that <u>only</u> the Summary pages/course material is allowed, no personal notes. Exams registration is done through your "KTH menu".

Responsible: Anders Eliasson, anderse@kth.se

Course schedule H19

Date Time Place ## Topic Chapter 1-1-12 Component casting. Cast house processes. Chapter 1-2 2.1-2.6 Component casting. Cast house processes. Chapter 1-2 2.1-2.6 Casting hydrodynamics. Chapter 3.	Б	TT'	D1	11	m ·	C1
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Literature: Materials Processing during Casting by Hasse Fredriksson and Ulla Åkerlind

<u>Chapter</u>	<u>Chapter</u>	<u>Activity</u>	<u>Exercises</u>	
1. Component Casting	Whole chapter	Carefully	-	-
2. Cast House Processes	2.1 - 2.4	Carefully	-	-
	2.5 - 2.6	Browse		
3. Casting Hydrodynamics	3.1 - 3.3.2 3.3.3 - 3.3.4 3.4 3.5 3.6 - 3.7	Carefully Browse Carefully Browse Carefully	3-1 3-2 3-3 3-4 3-5	3-6 3-7 3-8 3-9 3-10
4. Heat Transport during Component Casting	Whole chapter	Carefully	4-1 4-2 4-3 4-4 4-5 4-6	4-7 4-8 4-9 4-10 4-11
5. Heat Transport in Cast House Processe	5.1 - 5.3 5.4 5.5 5.6 5.7 5.8	Carefully Browse Carefully Browse Carefully Browse	5-1 5-2 5-3 5-4 5-5 5-6	5-7 5-8 5-9 5-10 5-11 5-12
6. Structure and Structure Formation in Cast Materials	6.1 - 6.4 6.5 - 6.6 6.7 - 6.9 6.10 - 6.11	Carefully Browse Carefully Browse	6-1 6-2 6-3 6-4 6-5	6-6 6-7 6-8 6-9 6-10
7. Microsegregation in Alloys – Peritectic Reactions and Transformations	7.1-7.3 7.4 7.5 7.6-7.9	Carefully Browse Carefully Browse	7-1 7-2 7-3 7-4 7-5	7-6 7-7 7-8 7-9
8. Heat Treatment and Plastic Forming	8.1 – 8.4 8.5 8.6	Browse Carefully Browse	8-1 8-2 8-3 8-4 8-5	8-6 8-7 8-8 8-9 8-10
9. Precipitation of Pores and Slag Inclusions during Casting Processes	9.1-9.7.5 9.7.6-9.7 9.8 9.9	Carefully Browse Carefully Browse	9-1 9-2 9-3 9-4 9-5	9-6 9-7 9-8 9-9 9-10
10. Solidification and Cooling Shrinkage of Metals and Alloys	f 10.1-10.5.1 10.5.2-10.6 10.7	Carefully Some Browse Browse	10-1 10-2 10-3 10-4 10-5	10-6 10-7 10-8 10-9 10-10
Macrosegregation in Alloys	11.1 – 11.5 11.6 – 11.9	Browse Carefully	11-1 11-2 11-3 11-4	11-6 11-7 11-8 11-9
Bold: recommended exercises.			11-5	