

KTH Royal Institute of Technology
School of Industrial Engineering and Management
Department of Materials Science and Engineering
Unit of Structure

POWDER METALLURGY (MH2100) 6 credits

Fall 2021

Teachers: Henrik Larsson, hlarsson@kth.se, Hans-Henrik König, hkonig@kth.se

Examiner: Greta Lindwall, gretal@kth.se (currently on parental leave, only answers mail intermittently)

Purpose

The aim of the course is to provide the students with knowledge about the field of powder metallurgy and to teach the students generic principles associated with creating powders and fabricating engineering shapes from those powders.

Intended learning outcomes

At the end of the course, the participants should demonstrate the ability to:

- Summarize and explain the different process steps characteristic for powder-based materials in general and for materials/processes of special interest for Swedish PM industry in particular.
- Explain and apply different methods for fabrication and characterization of powder.
- Explain different methods for compaction, pressing and forming of metal powder.
- Compare different methods of freeform fabrication in general and powder-based additive manufacturing in particular.
- Explain and apply the physical background of sintering in general and to sintering of cemented carbides in sintered steels in particular.

Lectures and exercise sessions

The course includes 6 lectures and 6 exercise sessions.

Practicals

The course includes three mandatory practicals: powder characterization (9/11, 4 groups: 9-10.30, 10.30-12, 16-17.30, 17.30-19), cemented carbides (25/11) and sintered steels (7/12).

Eligibility

MH2038 Micro and Nano Structures in Materials.

Literature

- Powder Metallurgy & Particulate Materials Processing (2005) by B. German (ISBN: 0-97620571-8)
- Additive Manufacturing Technologies by I. Gibson et al. (ISBN: 978-1-4939-2113-3 (eBook))
- Powder Metallurgy, B Uhrenius. PDF Uploaded on Canvas
- Handouts, collection of exercises

Examination

Participation in the practicals is required to pass the course in its entirety. Some practicals may also require a mandatory report (P/F).

Time is reserved for an oral exam on January 13, 14-18. However, by taking the voluntary written test on December 12 a course participant may pass the course (and acquire grade E-A).

Schedule (content is somewhat tentative)

Activity	Date, time, location	Content	Literature	Teacher
Lecture 1	1/11, 10-12, B22	Introduction, Powder fabrication	German: Ch. 1, 3 Uhrenius: Ch. 1-2	Henrik
Exercise 1	3/11, 13-15, B22	Powder fabrication	Handouts	Hans-Henrik
Lecture 2	8/11, 10-12, L22	Powder characterization	German: Ch. 2, 4 Uhrenius: Ch. 1-2	Henrik
Practical 1	9/11, 9-12 or 16-19, Swerim in Kista	Powder characterization	Handouts	Pelle Melin (Swerim)
Exercise 2	10/11, 14-16, B24	Powder characterization	Handouts	Hans-Henrik
Lecture 3	12/11, 15-17 Room TBD	Shaping, powder microstructure, full-density processes	German: Ch. 5-7, 10 Uhrenius: Ch. 3	
Lecture 4	15/11, 10-12, B22	Additive Manufacturing	Gibson: Ch. 1, 3 (3.2, 3.4, 3.7) and 5 (5.1, 5.2.2.2, 5.3, 5.5, 5.6.2, 5.6.3)	Sasan Dadbaksh, AM guest lecture
Exercise 3	18/11, 13-15, M37	Shaping, powder microstructure, full-density processes	Handouts	Hans-Henrik
Lecture 5	22/11, 10-12, B21	Sintering	German: Ch. 8, 9 Uhrenius: Ch. 4	Henrik
Exercise 4	24/11, 13-15, B22	Additive Manufacturing	Handouts	Hans-Henrik
Practical 2	25/11, 9-12, Blå	Cemented Carbides	Handouts	Andreas Blomqvist (Sandvik Coromant)
Lecture 6	29/11, 10-12, B22	Sintered Steels, Cemented Carbides, post processing	German: Ch. 12 Uhrenius: 1, 5, 6	Henrik
Exercise 5	3/12, 13-15, M23	Sintering	Handouts	Hans-Henrik
Practical 3	7/12, 13-17, Blå	Sintered Steels	Handouts	Marja Haglund (Höganäs)
Exercise 6	8/12, 13-15, M23	Sintered Steels, Cemented Carbides, post processing	Handouts	Hans-Henrik
Voluntary written test	10/12, 13-15(16) Room TBD			Henrik
Exam	13/1, 14-18, Reserved time for oral exam			