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

POWDER METALLURGY (MH2100) 6 credits
Fall 2017

Teachers: Henrik Larsson (hlarsso@kth.se) and Armin Salmasi (salmasi@kth.se).

Examiner: Joakim Odqvist

Course goals
After completing the course the student should be able to:

- Summarize the different steps taken during processing of powder-based materials in general and for cemented carbides and sintered steels in particular.
- Compare different methods for characterization and fabrication of powders.
- Compare different methods for compaction, pressing and shaping of powders.
- Explain the physical background to sintering in general and to sintering of cemented carbides and sintered steels in particular.
- Describe different methods for freeform fabrication, additive manufacturing and 3D-printing.
- Describe different finishing operations (after consolidation, sintering).
- Solve problems using simple mathematical relations and micrographs related to powders and their processing e.g. characteristics before and after sintering, microstructure evolution during sintering etc.

Lectures
Seven lectures (2x45 min. each) will be given. The whole course content is not covered by the lectures; each student needs to read the literature as well.

Exercises
There will be seven exercises where we solve problems. During the last exercise we go through an old exam.

Laboratory work
The course includes two mandatory labs: Cemented carbides (1/12) and Sintered steels (7/12).

Eligibility
MH2038 Micro and Nano Structures in Materials.

Literature
Uhrenius, B. *Powder metallurgy* (download from Bilda/Canvas)
German, R.M. *Powder Metallurgy & Particulate Materials Processing*. MPIF, 2005 (ISBN: 0-9762057-1-8)
Lecture notes, collection of exercises, home assignments and material handed out

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Schedule

Activity	Date, time and place	Contents	Literature	Who
Lecture 1	30/10, 15-17 Room: L31	Introduction. Powder characterization	RMG: ch1-2 BU: ch1-2	Henrik
Exercise 1	2/11, 10-12 Room: L31	Problems 1-6	EPM	Armin
Lecture 2	6/11, 15-17 Room: L31	Powder fabrication, milling and mechanical alloying	RMG: ch3-4 BU: ch2	Henrik
Exercise 2	9/11, 10-12 Room: L31	Problems 7-12	EPM	Armin
Lecture 3	13/11, 15-17 Room: L31	Compaction, pressing and shaping of powders	RMG: ch5-7 BU: ch3	Henrik
Exercise 3	16/11, 10-12 Room: U61	Problems 13-19	EPM	Armin
Lecture 4	20/11, 15-17 Room: Q11	Sintering theory and mechanisms	RMG: ch8-10 BU: ch4	Henrik
Exercise 4	23/11, 10-12 Room: B22	Problems 20-24	EPM	Armin
Lecture 5	27/11, 15-17 Room: M38	Freeform fabrication Additive Manu-factoring/3D-printing	RMG: ch11 Material handed out	Joakim Ålgårdh, Swerea Kimab
Exercise 5	30/11, 10-12 Room: K53	Problems 25-30	EPM	Armin
Lab 1	1/12, 9-12 Room: M121	Sintered steel Hard metals and cemented carbides	Material handed out	Marja Haglund, Höganäs.
Lecture 6	4/12, 15-17 Room: M38	Sintering of sintered steel. Properties. Finishing operations	BU: ch6 RMG: ch12	Henrik
Exercise 6	7/12, 10-12 Room: Q13	Problems 31-36	EPM	Armin
Lab 2	11/12, 15-18 Room: M121	Hard metals and cemented carbides	Material handed out	Andreas Blomqvist, Sandvik
Lecture 7	13/12, 13-15 Room: B23	Sintering of cemented carbides. Properties	BU: ch5	Henrik
Exercise 7	14/12, 10-12 Room: L31	Old exam problems	Material handed out	Armin
Exam	11/1 2018, 9-13 Rooms: M121			

RMG= Randall M German: “Powder Metallurgy & Particulate Materials Processing”

BU=Björn Uhrenius: “Powder Metallurgy”

EPM=”Exercises in Powder Metallurgy”