Ceramic and Colloidal Processing

Course Organisation

Andrea Testino

hip prosthesis

Ceramic and Colloidal Processing MSE-326

3rd year- semester 5 – the whole of MSE-326 will be given in ENGLISH

Room: MXG 110

Course and exercises

- Ceramic and Colloidal Processing (A. Testino) - 3 credits
- Tuesdays 9h15-12h00 – 2hrs course – 1hr exercises/discussion
- Lectures *ex cathedra* (in presence)
- Lectures and exercises in pdf format to be found on MOODLE for each week. They will be posted (updated) the Monday before course (at the latest).

TP: virtual

- Virtual and/or in class description of the practical work during the course
- See details on the overall program

Supporting Material

- Course mainly based on French book
- **Les Céramiques,** J. Barton, P. Bowen, C. Carry & J.M. Haussonne, Les Traité des Matériaux, Volume 16, PPUR, 2005 (5 books available EPFL library)
- But with accompanying books in English that cover all sections

English Books:

1. **Ceramic Processing and Sintering** - M. N. Rahaman Taylor & Francis, London, 2003 (available as e-book EPFL library)
2. **Fundamentals of Ceramic Powder Processing and Synthesis**, T.A. Ring – Academic Press, 1996 (available as e-book EPFL library)
3. **Principles of Ceramic Processing**, JSReed , Wiley, 1995 (available as e-book EPFL library)
4. **The Colloidal Domain** – DF Evans & H. Wennerström, Wiley, 1999. (5 books available EPFL library)

News of the year!

1. Each slide belongs to a category: **1** **2** **3**

1 Fundamental concept: must be clearly understood.

2 Insights that are fundamental to understand and clarify previous level.

3 Additional information which may contain details, equations, tables, examples which help to understand and compare.

News of the year!

2. Teaching method: ex-cathedra but

   A. All slides available in advance: You will have time to read them and address questions during the third hour if something is still not clear. It is not flip-class method, a kind of hybrid;
   B. You will have videos recorded during previous years, the course is very much similar but not exactly the same. Attending the class is highly recommended;
   C. You may formulate questions on the topic of that day. Questions and discussion will be assessed providing "+" to students.

3. Final evaluation

   A. At the oral exam, you will be asked to start with a topic of your choice;
   B. Your understanding of concepts among the diverse categories will define your final overall grade. If concepts under category 1 are not clear, the exam has high probability to fail;
   C. Your active participation during classes will be part of the final evaluation (example: +++ = 0.50, ++ = 0.25).

Exam

- Oral in January exam session
- 15 min
- No preparation, No notes etc.
- More information - October 31st …the mid-term test – where questions will be asked to the whole class and not individual students – the mid-term test will inform students of the typical method and typical questions asked
- The mid-term test will not be graded.
- Active participation during classes
- Final grade for MSE-326 (3 credits).

Date/ Time	Title
10 Sept 9.15-12.00 week 1	1.Introduction - ceramics et colloids- applications and examples **Exercises 1 (1h)**
17 Sept 9.15-12.00 week 2	2. Powder Characterization physical, chemical and morphology **Exercises 2 (1h)**
24 Sept 9.15-12.00 week 3	3. Raw materials and powder synthesis – solid-solid, solid -gas **Exercises 3 (1h)**
1 Oct 9.15-12.00 week 4	4. Powder synthesis, precipitation **Exercises 4 - Virtual TP – tbd**
8 Oct 9.15-12.00 week 5	5. Powder synthesis -gas phase et thermodynamics of solutions. **Exercises 5 (1h)**
15 Oct 9.15-12.00 week 6	6. Powder Treatment (1) Milling and classification. **Exercises 6 - Virtual TP - tbd**
29 Oct 9.15-12.00 week 7	7. Powder Treatment (2)- Dispersion and wetting, van der Waals forces **Exercises 7 -** Complete exercises 1-7 and revision /discussion questions on course or lab classes **NEXT WEEK exam method – mid-term test**…

Date/ Time	Title
5 nov ***9.15-12.00*** ***week 8***	8.: Interaction between charged surfaces -electrostatic repulsion - Colloidal stability : le DLVO model – aggregation kinetics – **Exercises 8 & EXAM…METHOD MID-TERM TEST**
12 nov ***9.15-12.00*** ***week 9***	9. Polymers in solution: solubility, conformation, adsorption at interfaces, Steric stabilization. Surfactants and micelles - colloids **Exercises 9 Hamaker program**
19 nov ***9.15-12.00*** ***week 10***	10. Powder Treatment (3) Rheology, mixing and granulation **Exercises 10 (1h)**
26 nov ***9.15-12.00*** ***week 11***	11. Ceramic forming methods dry pressing, tape casting, slip casting, drying and binder removal (burnout) **Exercises 11 (1h)**
3 dec ***9.15-12.00*** ***week 12***	12. Sintering: origin and phenomenology, kinetics and stages of sintering **Exercises 12(1h)**
10 dec ***9.15-12.00*** ***week 13***	13 Control of microstructures. Liquid phase sintering. Sintering technology. **Exercises 13**
17 dec ***9.15-12.00*** ***week 14***	14. Thin films and coatings **Exercises 14. Exam Method – Course Summary**