Course MATLS 3B03 – Winter 2023
Title: Manufacturing Engineering of Multifunctional & Biomedical Materials

Instructor:
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Office Hours:
Tue:12.00-2.00 pm

Teaching Assistants:
Michael MacDonald
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Calendar Description

Surface science and technology related to the preparation of fine particles of minerals, metals and ceramics for industrial production. Application of electrochemistry for diverse materials processing, such as electrometallurgy, thin film production and anodizing.
Three lectures; second term
Prerequisite(s): MATLS 2D03

3 lectures, second term
Tue, Thu, Fri 2.30-3.20 pm ABB 164

Evaluation

Midterm Test (March 2, ABB 164, 2.30-3.20 pm) - 20%
Assignment - 10% (Submission deadline March 7, 2023)
Presentation - 20%
Exam - 50%

Course Topics
Introduction.
Mass balance. Flow diagrams.
Solid state synthesis
Wet chemical methods. Precursors

Sol-gel processing.
Particle production and characterization
Powder metallurgy
Electrochemical manufacturing
Producton of materials from minerals. Hydrometallurgy
DLVO theory.
Colloidal processing
Cements
Self-assembly methods
Processing of polymers
Surfactants and dispersants. Binders.
Bioceramics. Biopolymers. Implant materials.
Bioglass. Drug delivery. Biosensors.
Surface modification techniques
Fabrication of composites

Course Objectives

At the conclusion of this course, the student should be able to:
1. Understand the large scale materials processing industry including the development of orebodies, microstructure of ores, and the processing methods used to liberate and selectively concentrate valuable minerals.
2. Understand the key performance parameters in mineral processing.
3. Understand the role of recycling and waste management in socially responsible use of resources.
4. Understand mass balance methodologies and be able to perform simple mass balances relevant to materials processing
5. Describe the principal manufacturing processes in terms of their capacity, energy consumption and product characteristics.
6. Understand the means to determine, describe and control particle size distribution, and the factors affecting the packing and mixing of powders as they relate to the production of ceramic components.
7. Understand the importance of surface properties in mineral upgrading and in stabilizing suspensions, and how these properties can be controlled to processing advantage.
8. Describe the processes available for leaching minerals and use Pourbaix diagrams to explain the chemistry of leaching and winning of metals.
9. Understand factors affecting the viability of electrowinning processes.
10. Relate this course to the career options of a materials engineer.

Textbooks

M.N.Rahaman, Ceramic Processing and Sintering, New York : M. Dekker, 2003
P.C. Hayes, Process Principles in Minerals and Materials Production, Third Edition, Hayes Publishing, Sherwood, Queensland, 2003

Policy Reminders:

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The Senate Resolution on Course Outlines states that:
“students should be reminded that they should read and comply with the "Statement on Academic Ethics and the Senate Resolution on Academic Dishonesty" as found in the Senate Policy Statements distributed at registration and available in the Senate Office”.
Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.
It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: http://www.mcmaster.ca/senate/academic/ac_integrity.htm
The following illustrates only three forms of academic dishonesty:
- Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

Disclaimer:

"The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes."