Course MTLS 3B03
Title: Manufacturing Engineering of Multifunctional & Biomedical Materials

Instructor:
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Office Hours:
Tue:2.30-4.30 pm

Teaching Assistants:
Angshuman Podder
Xinqian Liu

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

Schedule:
3 lectures, second term
Mon, Th 3.30-4.20 pm, Tu 4.30-5.20 pm, room HH 102

Evaluation:
Assignment - 10% - deadline Feb 25
Late submissions will be penalized 1% per day.
Test 1 (January 28, HH102, 4.30-5.20 pm) - 10%
Presentation - 30%
Exam - 50%

Course Topics:
Introduction.
Solid state synthesis
Wet chemical methods. Precursors
Sol-gel processing.
Particle production and characterization
Powder metallurgy
Electrochemical manufacturing
Production of materials from minerals. Hydrometallurgy
DLVO theory.
Colloidal processing
Cements
Self-assembly methods
Processing of polymers
Surfactants and dispersants. Binders.
Surface modification techniques
Fabrication of composites

Course Objectives and learning outcomes (CEAB attributes Knowledge):
At the conclusion of this course, the student should be able to:
1. Understand different solid state chemical routes for the fabrication of advanced complex oxide materials
2. Understand different solution and colloidal methods for the fabrication of advanced materials
3. Understand different precursors for the synthesis of nanomaterials
4. Understand production of advanced materials by electrochemical methods
5. Understand production of materials by hydrometallurgy
6. Understand methods of materials dispersion in colloidal suspensions
7. Understand tape casting and slip casting methods
8. Understand materials production by sol-gel method
9. Analyze mass balance for different materials production processes
10. Calculate yield of different materials fabrication methods
11. Select suitable chemical routes for the fabrication of advanced materials
12. Understand the large scale materials processing industry including the development of ore bodies, microstructure of ores, and the processing methods used to liberate and selectively concentrate valuable minerals.
13. Understand the key performance parameters in mineral processing.
14. Understand the role of recycling and waste management in socially responsible use of resources.
15. Understand mass balance methodologies and be able to perform simple mass balances relevant to materials processing
16. Describe the principal manufacturing processes in terms of their capacity, energy consumption and product characteristics.
17. Understand the importance of surface properties in mineral upgrading and in stabilizing suspensions, and how these properties can be controlled to processing advantage.
18. Describe the processes available for leaching minerals and use Pourbaix diagrams to explain the chemistry of leaching and winning of metals
19. Understand factors affecting the viability of electrowinning processes
20. Relate this course to the career options of a materials engineer.

Textbooks:
Policy Reminders:

Academic Integrity:
You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour 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 types of academic dishonesty please refer to the Academic Integrity Policy, located at .
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.

Academic Accommodation:
Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University’s Academic Accommodation of Students with Disabilities policy.

Missed Work:
In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”.

Academic Accommodation for Religious, Indigenous or Spiritual Observances:
Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar’s Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Extreme Circumstances:
The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.
Completed by Igor Zhitomirsky, January 2nd, 2020