MATLS 4D03/6D03: CORROSION AND ITS CONTROL
Fall Term 2020 (Online)

Administrative Details

Instructor: Dr. J. Kish
Offices: JHE 343B
E-mail: kishjr@mcmaster.ca
Office Hours: By email request.

Lectures:
- Monday from 11:30 AM to 12:20 PM
- Tuesday from 10:30 AM to 11:20 AM
- Wednesday from 10:30 AM to 11:20 AM

TAs: Caleb Whittier (whittiecmcmaster.ca) (grading)

Course Website:

MATLS 4D03/6D03 will use the Avenue to Learn (A2L) web-based course management system. Students can access the dedicated A2L course site via their MacID and password. The A2L course site is the main means of communication between myself (instructor), the TA and the registered undergraduate and graduate students and should be consulted regularly. Course announcements (including important due dates), lecture content, assignments, class tests, demonstrations, schedules, and other important course information will be posted on the A2L course site. Students are reminded that they are solely responsible for keeping up-to-date with all course announcements, instructional materials and due dates, including postings on the A2L course site. Students should let me know via email (kishjr@mcmaster.ca) if they encounter problems with the A2L course site.

Online Lecture Delivery:

Lectures will be given synchronously during the regularly scheduled lectures using the ZOOM platform. I will include regular question period breaks within each 50 minute lecture to field questions from the students. The protocol is to either (i) type your question using the “group chat function: or (i) use the “raised hand function” if you prefer to orally ask your question during a given question period. All lectures will be scheduled into ZOOM. Specific details regarding ZOOM access will be posted on the A2L course site.
There is no formal tutorial assigned to (scheduled for) this course. However, a set of lectures have been set aside to run tutorials in advance of assignment due dates. Please refer to the lecture schedule that is posted on the A2L course site for the specific lectures that have been designated as tutorials.

Course and Learning Objectives

Objectives:

By the end of this course, students should be able to:

1. Recognize characteristic features associated with the eight forms of corrosion.
2. Identify material-environment combinations that represent high risk for corrosion.
3. Apply mixed potential theory to rationalize and measure corrosion susceptibility.
4. Understand that corrosion must be considered in design processes.
5. Propose appropriate control measures to mitigate corrosion.

CEAB Graduate Attributes:

The selection of corrosions science and engineering topics addressed in this course will contribute to your specialized engineering knowledge (Attribute 1.4). Examples of corrosion and its consequences with contribute to your understanding of the impact of engineering on society and the environment (Attribute 9.1). The corrosion control case study will contribute to Attribute 2 (Problem Analysis) and Attribute 7 (Communication Skills).

Materials & Fees

Primary Resource: (Available for Purchase at Titles)


Supplemental Resources:

- ASM Handbook 13B “Corrosion: Materials”
- ASM Handbook 13C “Corrosion: Environments and Industries”
- http://corrosion-doctors.org/ (Corrosion Science & Engineering Information Hub)

Course Overview and Assessment

Overview:

1. *Corrosion Thermodynamics* – Corrosion reactions, cell requirements, free energy change, electrochemical potential, Eh-pH (Pourbaix) diagrams, Nernst equation, reference electrodes
2. *Corrosion Kinetics* - Solvation, electrical double layer, exchange current density, activation and mass transport control, mixed potential theory, polarization diagrams, passivity

3. *Forms of Corrosion* – Uniform corrosion, galvanic corrosion, pitting corrosion, crevice corrosion, intergranular corrosion, dealloying corrosion, erosion/cavitation/fretting, environmentally assisted cracking (including dissolved hydrogen effects)

4. *Corrosion Control Strategies* – Materials selection, process control, thermodynamic control (cathodic protection), kinetic control (anodic protection and corrosion inhibitors), protective metallic and non-metallic coatings

Assessment:

1. Corrosion Problem Awareness Assignment* $\text{--}$ 10%
2. Concept Assignments $\text{--}$ 10%
3. Concept Test 1 (Corrosion Thermodynamics) $\text{--}$ 20%
4. Concept Test 2 (Corrosion Kinetics) $\text{--}$ 20%
5. Corrosion Failure Case Study (MATLS 4D03)* $\text{--}$ 40%
6. Small-Scale Literature Review (MATLS 6D03)$ ^{\dagger}$ $\text{--}$ 40%

*Note that the corrosion problem awareness assignment and the corrosion failure case study are team effort involving the undergraduate students only (that is, those students enrolled in MATLS 4D03), each of which requires the preparation and submission of a formal written report. Specific details pertaining to requirements of these components will be uploaded onto the A2L course site as separate documents (corrosion failure case study after the mid-term recess).

$ ^{\dagger}$Note that the corrosion problem awareness assignment and the small-scale literature review are an individual effort involving graduate students only (that is, those students enrolled in MATLS 6D03), each of which requires preparation and submission of a formal written report. Specific details pertaining to requirements of these components will be uploaded onto the A2L course site as separate documents (small-scale literature review after the mid-term recess).

Due Dates:

The following are approximate due dates for major course components. Students should note that project due dates are subject to minor alterations depending on the delivery of lecture content and other factors. The exception is the submission of the Corrosion Failure Case Study report (MATLS 4D03) and Small-Scale Literature Review (MATLS 6D03 students), which are due on the final date of classes. It is the student’s responsibility to update themselves to any alterations in the due dates for coursework via in-class announcements or the A2L course website.

<table>
<thead>
<tr>
<th>Component</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion Problem Awareness Assignment</td>
<td>Friday, September 25, 2020</td>
</tr>
<tr>
<td>Concept Assignments</td>
<td>(about every second week)</td>
</tr>
<tr>
<td>Concept Test 1 (Corrosion Thermodynamics)</td>
<td>Wednesday, October 7, 2020</td>
</tr>
<tr>
<td>Concept Test 2 (Corrosion Kinetics)</td>
<td>Wednesday, November 4, 2020</td>
</tr>
<tr>
<td>Corrosion Failure Case Study</td>
<td>Wednesday, December 16, 2020</td>
</tr>
<tr>
<td>Small-Scale Literature Review</td>
<td>Wednesday, December 16, 2020</td>
</tr>
</tbody>
</table>
Additional Statements

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. It is your responsibility to understand what constitutes academic dishonesty. 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. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/

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.

Authenticity/Plagiarism Detection:

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster’s use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Courses with an On-Line Element:

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.
Online Proctoring:

*Some courses may* use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations:

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, whether in person or online.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

Academic Accommodation of Students with Disabilities:

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

Requests for Relief for Missed Academic Term Work

McMaster Student Absence Form (MSAF): 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 (RISO):

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the *RISO* policy. Students 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.
Copyright and Recording:

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, including lectures by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

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.