

MATLS 4LA2 “Heat-treatable Al alloys” 2021 – 2022

Course outline

Instructor

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Teaching assistant

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Course Web site

http://matls.mcmaster.ca/faculty_staff/faculty/malakhov/4LA2/4LA2.html

This Web site, which is frequently updated by the instructor while the course is unfolding, must be considered as an integral part of the course outline.

Learning outcomes

In this course, students will

1. Convince themselves that a microstructure determines properties by accumulating, analyzing and rationalizing experimental observations
2. Become familiar with different series of both heat-treatable and non- heat-treatable Al alloys and the temper designation system
3. Gain a deep understanding of mechanisms contributing to the strength of Al alloys
4. Realize how the concept of driving forces explains the formation of metastable phases during solidification and artificial ageing
5. Be able to rationalize as-cast microstructural characteristics of Al alloys including the presence of a mysterious equiaxed region
6. See what hot rolling and recovery do to a microstructure
7. Become fluent with the mathematical aspects of recrystallization
8. Be trained to use HF-containing etchants safely
9. Learn how to use temperature controllers and construct calibration plots to ensure that temperature of the artificial ageing recommended for a particular alloy is not deviated from
10. Observe that there exists a maximum on a hardness vs. time plot
11. Use calorimetry to catch thermal events accompanying solidification and ageing
12. Explore O, T₄ and T₆ tempers of 6066 alloy and fracture surfaces using SEM
13. Observe various nano-sized precipitates inside an FCC matrix and associated stresses during a TEM session conducted at the Canadian Centre for Electron microscopy.

14. Enjoy a chance to apply knowledge gained from an already taken course on mathematical statistics for analyzing their own experimental data

Textbook

This course does not rest on a mandatory textbook.

The following textbooks are recommended for students truly interested in aluminum alloys:

1. William F. Hosford “Physical metallurgy”
2. Alan M. Russel, Kok Loomg Lee “Structure-property relations in nonferrous metals”

Course structure

1. Every week, there is one lecture. The attendance is not controlled.
2. Every week, a student working as a part of a group carries out experiments described in the Lab Manual.

Lab reports

1. Each group must submit a draft of the lab report to a TA **not later than at 23:59 on the 4th of March 2022**, *i.e.*, shortly after the mid-term recess. It will be explained in details what is expected from the draft, which should be focused on theoretical aspects of the course. Also, a marking scheme is posted on the course Web site¹.
2. The final reports from each group will have to be submitted **not later than at 23:59 on the 14th of April 2022**. A corresponding marking scheme is posted on the course Web site¹.

Mark breakdown

| Course component | Contribution to the final mark, % |
|--|--|
| Draft of the Lab Report | 15 |
| Lab Report | 60 |
| Closed-book examination (50 multiple choice questions) | 25 |

Marks earned for non-mandatory SEM and TEM quizzes will be added to marks for lab reports (details will be posted on the course Web site).

¹ http://matls.mcmaster.ca/faculty_staff/faculty/malakhov/4LA2/4LA2.html

If a student scores less than 33% on the final examination, then a mark granted for this course will be F regardless of marks earned for the Draft and the Report.

Regulations, policies, procedures and guidelines

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](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), 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.