

CME 570: DIFFUSION PHENOMENA IN MATERIALS (4 CREDIT HOURS)

Class Meetings: Monday, 5:30 pm - 8:00 pm, Lincoln Hall 100

Instructor & Contact Information

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Course Schedule

Monday, 5:30 pm - 8:00 pm, Lincoln Hall 100

Office Hours: Wednesday 6:00 pm - 7:00 pm, or by appointment via email. The office hour is online on Blackboard collaborate.

Grading Scheme

Problem Sets	30 %
Midterm Examination	30 %
Final Examination	30 %
Projects	10%

Important dates

Labor Day holiday. No class.

September 7, Monday

Midterm Examination

TBD

Final Examination

December 6, Monday, 5:30 – 8:00 pm

Students who have a conflict with the midterm/final examination date and time should notify the instructor by the end of the first week of classes. Overlaps with other courses examinations are considered as an acceptable conflict.

Course Summary

The course is divided into two parts. The first part contains the fundamental knowledge to understand diffusion at the continuum and atomic levels. The second part deals with understanding diffusion phenomena in different solids, including alloys and ionic solids. Additionally, we will discuss the role of materials microstructure on diffusion. Case studies of diffusion in alloys and ceramics are incorporated to provide a link between theory and practice.

Prerequisite: No official one. An undergraduate level understanding of mathematics and physics is assumed.

Course Outline

1. Fundamentals of Diffusion

- a) Continuum Theory of Diffusion
 - i) Fick's First Law
 - ii) Fick's Second Law or Diffusion Equation
 - iii) Solution to Diffusion Equation
- b) Atomistic Theory of Diffusion
 - i) Random Movement and the Diffusion Coefficient
 - ii) Mechanisms of Diffusion
 - iii) First-principles Calculation of Diffusion Coefficient
 - iv) Experimental Determination of Diffusion Coefficient

2. Diffusion Phenomena in Solids

- a) Interdiffusion and Kirkendall Effect
- b) Diffusion in Alloys
- c) Diffusion in Ionic Materials
- d) Kinetics of Diffusion-Controlled Processes

Weekly Lecture Notes: The lecture content will be released to students on a week-by-week schedule. Lecture content will be available for viewing through Blackboard. Students are encouraged to review the content before attending the synchronous meetings.

Course Textbook

Paul Shewmon, Diffusion in Solids, 2nd ed., Springer International Publishers, 2016
Available for free at the UIC library. See the “Library Resources” panel on Blackboard.

Helmut Mehrer, Diffusion in Solids, Springer-Verlag Berlin Heidelberg, 2007
Available for free at the UIC library. See the “Library Resources” panel on Blackboard.

Extra Readings

Boris S. Bokstein, Mikhail I. Mendeleev, and Davod J. Srolovitz. Thermodynamics and Kinetics in Materials Science, Oxford University Press, 2005

Technology Requirements/Blackboard Use:

Students will need regular access to a personal computer that runs on a stable Internet connection. Blackboard will be used to distribute all course materials, for the submission and return of graded assignments, and for the communication of grades. Midterm and final exam will be distributed and collected using Blackboard. Expect to use blackboard for all information sharing and deliverable submission in this course, except when noted otherwise.

Attendance Policy

Attendance in class will be formally recorded and is required.

Academic Integrity Policy

Students are expected to complete all assignments independently. *Please note, the posting of any course materials to any public forum, website, or discussion group is not permitted without the express permission of the instructor.* Any unauthorized posting of materials will be treated as academic misconduct. Instances of academic misconduct by students will be handled pursuant to the [Student Disciplinary Policy](#).

As an academic community, UIC is committed to providing an environment in which research, learning, and scholarship can flourish and in which all endeavors are guided by academic and professional integrity. All members of the campus community—students, staff, faculty, and administrators—share the responsibility of ensuring that these standards are upheld so that such an environment exists.

Religious Holidays

The instructor will make an effort to accommodate the observance of religious holidays with respect to coursework and examinations. Students wishing to observe a religious holiday during the academic term must notify the instructor by the end of the first week of classes.

Disability accommodation

The University of Illinois at Chicago is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at UIC. Students with disabilities who require accommodations for access to and/or participation in this course are welcome but must be registered with the Disability Resource Center (DRC). You may contact DRC at 312-413-2183 (v) or 773-649-4535 (VP/Relay) and consult the [university resources](#).

Assignments

Assignments are distributed approximately every two or three weeks. Assignments are released on Monday morning at the beginning of the week and are due next Monday at 11:59 pm.

Late Submission Policy for Assignments

The penalty for late submission of assignments is 20%/day, up to two days (including the days of the weekend) of lateness being tolerated. After this time, the late material will NOT be marked, and a grade of zero percent will be registered for the particular part(s) of the course. Unless otherwise specified, deliverables will be due at 11:59 pm of the day indicated. Submissions must be uploaded prior to this time to Blackboard, unless otherwise indicated. In the case of multiple uploads, I will only mark the last submission received before the two-day cutoff. Deliverables received after the deadline will have the full 20%/day penalty levied. Submissions may not be uploaded piecemeal. For example, a student may not submit the first 3 problems of a 6-question problem set assignment before the deadline and then the remainder 1 day late. The total assignment will be considered 1 day late. Each assignment should be submitted as a single file.

Face Masks

Masks covering both the mouth and nose must be worn at all times by all students, faculty, and staff while on campus and inside any building regardless of vaccination status. If you do not wear a mask, you will be asked to leave the classroom and will not be allowed back in class unless or until you wear a mask. If you have forgotten your mask, you may pick one up from one of the student information desks on campus during the first two weeks of campus. Students who do not comply with the mask-wearing policy will be reported to the Dean of Students. Eating and drinking are not allowed in classrooms