Kinetic Processes in Materials
3.21 Spring 2002
Professor Sam Allen   Professor Craig Carter
Department of Materials Science and Engineering
Massachusetts Institute of Technology
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Course Information

3.21 Staff

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Grading

Exams There will be two exams of 1.5 hours duration. There will be **no** final exam.

- Exam 1 will be given **Wednesday 20 March** and will cover the material presented up to 15 March.
- Exam 2 will be given **Monday 13 May** and will cover the material presented between 18 March and 8 May.

Homework Over the years in this and other Course III graduate subjects, students have found it helpful and a valuable learning experience to work together in teams to develop approaches to solve problems posed on assignments. We see several benefits to such collaborations, including:

- More efficient use of time

- Improved mastery of subject matter

- Valuable experience in group dynamics

We will establish teams of 3 or 4 students who will collaborate on preparation of problem set solutions. Group assignments will be made after we have conducted an assessment of skills that we believe are helpful for success in the context of the groups-that is, we will attempt to "balance" each group so that particular skills are distributed among all groups.

Each group will be required to complete each problem set, but only one problem set submission will be accepted per group. All members of the group will receive the same score on each problem set.

We will set membership in the groups and announce them on Friday, February 8. On that day, all class periods (lecture and recitations) will be conducted by Professor Lori Breslow of MIT's Teaching and Learning Center. These sessions will introduce important skills that should help ensure that the group learning experience is successful.

Problem sets will be assigned on Mondays and will be due the following Monday **by 5 P.M. in the Grader's office**, unless otherwise noted.

Final Grade The semester grade will be determined by the exams (each 25%), the homework (25%), and class participation (25%).

Text and Reading Materials

Primary Text

text, as well

Copies of a text written by Robert W. Balluffi, Samuel M. Allen, and W. Craig Carter will be available for purchase in the MIT Copy Technology Center, Room 11-004.

Kinetics is a very large and eclectic field and no one text deals exclusively with the entire list of topics which we will cover. You may want to consult the books listed below, some of which are available at the reserve book room, 14N-132. Reference will also be made to important papers in the field.

Additional Reference Material

General

- Cahn and Haasen [1]

- Christian [3] (on reserve)

- Porter and Easterling [12] (on reserve)

- Martin and Doherty [11]

- Kingery, Bowen, and Uhlmann [9] (on reserve)

Thermodynamics and Statistical Physics

- Yourgrau, van der Merwe, and Raw [13]
- Lifshitz and Pitaevskii [10]
- Denbigh [6]

Diffusion

- Girifalco [7] (on reserve)
- Crank [4, 5]
- Carslaw and Jaeger [2]
- Jost [8]

References

[1] R W Cahn and P Haasen. *Physical Metallurgy*. North Holland, 4th edition, 1996. in three volumes.

[2] H.S. Carslaw and J.C. Jaeger. *Conduction of Heat in Solids, 2nd Ed.* Oxford University Press, Oxford, 1959.

[3] J W Christian. *The Theory of Transformations in Metals and Alloys*. Pergamon Press, Oxford, 1975.

[4] J. Crank. *The Mathematics of Diffusion, 2nd Ed.* Oxford University Press, Oxford, 1975.

[5] J. Crank. *Free and Moving Boundary Problems*. Oxford University Press, Oxford, 1984.

[6] K Denbigh. *The Principles of Chemical Equilibrium*. Cambridge Univ. Press, 3rd edition, 1971.

[7] L A Girifalco. *Atomic Migration in Crystals*. Blaisdell, 1959.

[8] W Jost. *Diffusion in Solids, Liquids, and Gases*. Academic Press, 1952.

[9] W D Kingery, H K Bowen, and D R Uhlmann. *Introduction to Ceramics*. John Wiley and Sons, New York, 1976.

[10] E.M. Lifshitz and L.P. Pitaevskii. *Statistical Physics, 3rd ed, Part 1*. Pergammon Press, New York, 1980. see pages 365ff.

[11] J W Martin and R D Doherty. *Stability of Microstructures in Metallic Systems*. Cambridge University Press, 1976.

[12] D A Porter and K E Easterling. *Phase Transformations in Metals and Alloys*. van Nostrand Reinhold, 1981.

[13] Wolfgang Yourgrau, Alwyn ven der Merwe, and Gough Raw. *Treatise on Irreversible and Statistical Thermophysics*. Dover Publications, Inc., New York, 1982.