ChE 152, Winter 2015
Heterogeneous Kinetics and Reaction Engineering

Instructor: Prof. Mark E. Davis, 215 Spalding, x4251, mdavis@cheme.caltech.edu
Office hours: by appointment

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Lectures: MWF 2:00-2:55 in Spalding 102

Main Reference

M.E. Davis and R.J. Davis, Fundamentals of Chemical Reaction Engineering. Mc Graw-Hill, New York, 2003. Full text is available online through the Caltech Library system at http://resolver.caltech.edu/CaltechBOOK:2003.001

References

(on reserve at Sherman Fairchild Library)

1. J.M. Smith, Chemical Engineering Kinetics, 3rd ed. McGraw-Hill, New York, 1981.

2. G.F. Froment and K.B. Bischoff, Chemical Reactor Analysis and Design, 2nd ed. Wiley, New York, 1990.

3. J.M. Thomas and W.J. Thomas, Principles and Practice of Heterogeneous Catalysis. VCH, Wernheim and New York, 1997.

4. C.N. Satterfield, Heterogeneous Catalysis in Industrial Practice. McGraw-Hill, New York, 1991.

5. G.W. Parshall and S.D. Ittel, Homogeneous Catalysis: The Applications and Chemistry of Catalysis by Soluble Transition Metal Complexes, 2nd ed. Wiley, New York, 1992.

6. B.C. Gates, Catalytic Chemistry. Wiley, New York, 1992.

7. M. Boudart and G. Djéga-Mariadassou, Kinetics of Heterogeneous Catalytic Reactions. Princeton University Press, Princeton, NJ, 1984.

Course Outline

1. Properties of Metal-Containing Solid Catalysts (notes)
   - A. Physical Adsorption
   - B. Chemical Adsorption
   - C. Characterization Methods

2. Kinetics of Solid Catalyzed Reactions (D&D, Chapter 5)
   - A. Kinetics of Elementary Steps
   - B. Kinetics of Overall Reactions
   - C. Rate Constant Issues (notes)
   - D. Microkinetic Analysis (D&D, Chapter 7)

3. Effects of Transport Limitations on Rates of Solid Catalyzed Reactions (D&D, Chapter 6 and notes)
   - A. Internal Transport Effects
   - B. External Transport Effects
   - C. Overall Behavior

4. Heterogeneous Reactors
   - A. Dispersion (D&D, Chapter 8)
   - B. Fixed-Bed Reactor Models (D&D, Chapter 10)
   - C. Other Heterogeneous Reactors (D&D, Chapter 10 and handouts)

5. Other Types of Solid Catalysts (notes)

Grading: Homework 30% Mid-term Exam 35% Final Exam 35%

Homework and Exam Policies:

1. If an extension of time is requested for homework, the request must be submitted to Prof. Davis by email with a spcification as to when it will be submitted. Prof. Davis will respond and cc the TA so that all concerned are notified of any changes.

2. Discussions of homework grades must be completed with the TA no later than 2 weeks after the homework problems have been returned. Beyond this time, no requests for corrections will be accepted.

3. If questions concerning the grading of an exam is raised, Prof. Davis has the right to re-evaluate not only the portion of exam in question, but the whole exam.

4. Viewing homework and exams from previous years will be considered an honor code violation.

5. Homework can be done together – acknowledge members.

6. Exams are open anything but colleague.