

**Chemistry 4066**  
**Chemistry in Industry**  
**Spring, 2017**

*This course will correlate basic chemical theory, properties and reactions to commercially important materials critical to contemporary everyday life, including polymers, inorganic materials, nano-technology and surfactants. In addition, research and development in today's industrial environment will be discussed including the role of the industrial chemist and the interactions between business objectives, scale-up issues, research collaborations, patents and publications. You **must** have a good chemistry background to successfully complete this course.*

***Selected course topics:***

Industrial Polymer Chemistry Overview

Synthesis & applications of Industrial Polymers

Applications of Polymer Blends and Composites – Nanotechnology and Renewable Resource Polymers

Interfacial Applications of Polymers

Hot Fields for the Polymer Chemist

The R&D process, from concept to product, steps in the process, interdepartmental relationships.

Introduction to Fiber reinforced Thermoset Composites

Industrial Microwave Chemistry

Surfactants: theory, synthesis, production and use in personal care

Emulsion theory and practice, stability and formulations

Natural aroma compounds

Sunscreens, theory and formulations

Green chemistry in personal care R&D

The chemistry of photography

Applications of inorganic nanotechnology

The industrial chemistry of silicates: what a difference a cation makes

Manufacture of raw materials used by industry

Industrial chemistry of explosives

Manufacturing and applications of dyes and pigments

Catalysis in industrial processes

**Instructors:** Jim Nelson, 651-736-5295, jnelson1@mmm.com. Biography: 4/2007 – Present; Adv. Product Development Specialist, Composites Group, 3M IATD. 4/2005 – 4/2007; Project

Leader: 3M Dyneon, LLC. 10/2003–4/2005: Project Leader: 3M Industrial Business Lab. 9/1997–9/2003: Research Specialist/Senior Research Chemist: 3M CPTC; 7/2002–3/2003: 3M-IPRIME Industrial Fellow, Univ. Minnesota; Professor M. Hillmeyer.; 9/1995-8/1997: Natural Science and Engineering Council of Canada Postdoctoral Research Scholar, Pennsylvania State University. Advisor; Professor H. R. Allcock.; 4/1992-8/1995: Ph.D. Chemistry, University of Toronto; Advisor: Professor I. Manners; 7/1990-4/1992: M.Sc. Chemistry, Queen's University. Advisor: Professor M. C. Baird; 9/1986-6/1990: B.Sc. Specialist in Chemistry- University of Toronto. His doctorate thesis work, under the tutelage of Professor Ian Manners, involved the development of new synthetic methods for producing new to the world monomer systems and polymers containing transition metal (iron, ruthenium, cobalt) and main group elements (nitrogen, boron, phosphorus) in their backbone. He joined 3M's Corporate Process Technology Center in 1997 and developed several new process technologies and polymeric materials for various interfacial applications in that role. In 2007, he joined 3M Industrial Adhesive and Tape division as an Advanced Product Development Specialist to commercialize new materials related to fiber composites. In his career, Dr. Nelson has co-authored 40 scientific publications and 35 US Patents.

Tim Kapsner, kapsn011@umn.edu. Biography: BA from University of MN, Morris. Did graduate work at U of M Minneapolis in Philosophy. From 1977 to 1990 he worked for Minnetonka Inc., creating products for brands such as Softsoap, Sesame Street, Calvin Klein and Check-Up Toothpaste. He joined Aveda, a subsidiary of Estee Lauder Companies, in 1993, researching natural ingredients for cosmetic functions such as preservation, foaming and emulsification. As of the fall of 2016 he is retired from Aveda. He has worked for 10 years to bring the organic food certification programs and standards to the personal care industry. He has numerous patents and publications, including a recent chapter on natural sunscreen technology. Tim is a co-founder and co-chair of the Minnesota Green Chemistry Forum, a cross-sector nonprofit dedicated to communication, collaboration and education in the local and regional green chemistry community.

David Whitcomb, 651-343-2907, [david.whitcomb@minneapolis.edu](mailto:david.whitcomb@minneapolis.edu). Biography: BA, PhD, joined 3M starting research on the inorganic chemistry of aluminum, nickel, iron and silver in imaging chemistries including the reaction mechanisms of photothermographic imaging materials involving silver halide/silver carboxylate nano- to mesophase materials. He has characterized the silver compounds involved in the formation of metallic silver nanoparticles that comprise the image in photothermographic based medical diagnostic films. This work also includes understanding optical properties of the metallic silver nanoparticles as a function of size and shape, and providing new silver chemistries for overall imaging performance improvements. The diagnostic medical X-ray film business based on photothermography was transferred to three different companies, currently residing at Carestream Health, Inc. He has developed silver nanowire technology for applications in transparent conductive films, holds 41 patents and has over 60 technical publications. Recently retired from industrial research, he also teaches chemistry at Minneapolis Community & Technical College, and is the president of the consulting company Red Streak Partners, LLC.

**Office Hours:** Instructors are available by appointment.

**Webpage:** <http://www.chem.umn.edu/class>

**Class Hours:** 4:00 – 5:15 p.m. TTh, Akerman Hall 215

**Special Note:** Please turn cellular phones and pagers *off* before entering the classroom.

**Textbook:** None

**Midterm Exams:** February 16, March 30, May 4 (Thursdays) in Akerman Hall 215 at the regular class time.

**Final Exam:** None

**Policy on Exams:** Exams will cover all of the material presented by the individual instructors. *All examinations must be taken on the dates/times indicated above.*

**Policy on Absences:** Exams can only be missed due to illness or family emergency. The reason for missing an exam must be acceptable to the individual instructor and documentation must be provided, if requested.

**Policy on I Grade:** Incomplete grades are rarely allowed and granted only under exceptional circumstances. It will only be **considered** if work completed to that date is satisfactory.

**Grading:** Three hourly exams, 100 points each: final grade is based on the percentage of the total score. Homework assignments will be credited as part of the exam score as determined by the individual instructor.

**Scholastic Dishonesty Policy:** “Scholastic dishonesty is any act that violates the rights of another student with respect to academic work or that involves misrepresentation of a student's own work. Scholastic dishonesty includes (but is not limited to) cheating on assignments or examinations, plagiarizing (misrepresenting as one's own anything done by another), submitting the same or substantially similar papers (or creative work) for more than one course without consent of all instructors concerned, depriving another of necessary course materials, and sabotaging another's work.” — *Classroom Grading and Examination Procedures*, College of Liberal Arts.

*A student guilty of scholastic dishonesty will be awarded a grade of zero (0) for the work involved and that score will not be dropped in calculating the final course grade. Furthermore, the incident will be reported to the Scholastic Conduct Committee of the college in which the student is enrolled.*

**How To Do Well In This Course:**

*Come to class and participate.* Attendance is not taken, but since there is no textbook you need to attend class. Exams are based on lectures and homework assignments. Ask questions if there is something you do not understand. Other students will often have the same question and will be glad that you asked it.