

Spring 2023, Chem 573 Syllabus, Nanochemistry, 2 credits

(this/other key maters. on [Cybox: iastate.box.com](http://Cybox:iastate.box.com))

Meets: Mon & Wed 11-11:50 am, 1114 Gilman.

Office hrs. Mon & Wed 12:00-1 pm, or by appointment.

Dr. Javier Vela, University Professor

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Suggested textbooks: (none of this is required)

- Owens & Poole (O&P), *The Physics and Chemistry of Solids*, Wiley, 2008
- Hornyak, Dutta *et al.*, *Introduction to Nanoscience*, CRC, 2008
- Kuno, *Introductory Nanoscience*, Garland Science, 2012
- Cao & Wang, *Nanostructures and Nanomaterials*, 2nd Ed., World Scientific, 2011
- Lindsey, *Introduction to Nanoscience*, Oxford, 2010

"(2-0) Cr. 2. Alt. S., offered odd-numbered years. Prereq: CHEM 301, CHEM 324

Synthesis, characterization, properties and applications of nanoscale materials (\approx 0.5-500 nm), relationship with molecular, meso and bulk compounds. Chemistry of solid surfaces, zero-, one- and two-dimensional nanostructures (0D, 1D, 2D), semiconductor quantum dots, plasmonic nanoparticles, carbon nanomaterials, porous nanomaterials, potential health and safety impacts."

Class structure: Lecture plus in-class discussion and presentations. You are expected to read appropriate textbook content and any assigned papers in advance of class. Must attend the seminars below.

<u>Week(s)*</u>	<u>Subject*</u> (* = <u>tentative</u>)	
Week 1	Course Intro & Syllabus, Nanosolids: Structures (O&P Ch 1)	
Week 2	Polytypism, lattice mismatch	
Week 3	Epitaxy, gdots & blinking, cation exchange	
Week 4	Nanosolids: Surfaces (O&P Ch 1)	
Week 5	Owen/Green nomenclature	
Week 6	Characterization (O&P Ch 2), Bragg, Scherrer, PLE	
Week 7	Nano vs. bulk (O&P Ch 3)	
Week 8	Synthesis and reactivity (O&P Ch 4)	
Week 9	Nucleation theory, La Mer, ripening, molecular tuning, single source precursors, ligand removal	
Week 10	Molecular tuning, single source precursors, ligand removal	
Week 11	Morphology, Nanocarbons	
Week 12	Nano bonding (O&P Ch 6)	
Week 13	Transport (O&P Ch 8), photovoltaics	

	Nanostructuring (O&P Ch 11), porosity/porous materials, sol-gel, surface area/BET	
Week 14	Review	
Week 15	Final exams - <u>date/time tbd</u>	

Grading composition (out of 100):

Exams (80): One midterm (40), one final (40) (dates tbd). All exams are open book(s)/open resource(s).

Problem sets: 20 (2 random end-of-chapter from O&P upon completion of each chapter).

Optional project, worth up to a maximum of 10 extra points, for either:

- Development of a nanochemistry lab demonstration based on a 573-related topic, or creation of a Wikipedia article on a 573-related topic (to be pre-approved by me, must explain a concept or idea to the general public/lay audience).

Grading scale: A=100-95%, A⁻=94-90%, B⁺=89-86%, B=85-83%, B⁻=82-80%, C⁺=79-76%, C=75-73%, C⁻=72-70%, D⁺=69-66%, D=65-63%, D⁻=62-60%, F=59-0%

Free Expression

Iowa State University supports and upholds the First Amendment protection of [freedom of speech](#) and the principle of [academic freedom](#) in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

Academic Dishonesty

The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the [Dean of Students Office](#).

Accessibility

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

Face Masks Encouraged: Because of the continuing COVID-19 pandemic, everyone is encouraged—but not required—to wear face masks.

Vaccinations Encouraged: All students are encouraged to receive a vaccination against COVID-19. Multiple locations are available on campus for free, convenient vaccination. Further information is available

at: <https://web.iastate.edu/safety/updates/covid19/vaccinations> Vaccinations may also be obtained from health care providers and pharmacies.

Discrimination and Harassment

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu