



## Nano-Chemistry

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
CHM	448	Nano-Chemistry	2	2	0	0	CHM 344

### Objectives:

- To provide student with the basic concept of Nanochemistry and changes of chemical and physical properties due size reduction.
- To introduce students to the synthesis, characterization, fictionalization, and application of nano- materials.

### Syllabus:

**Introduction to Nanochemistry:** Inorganic Materials Chemistry and Nanochemistry; Basics Nanomaterials

**Nanoparticles:** Types, compositions, and structures, Metal and semiconductor nanocrystals, Porous inorganic nanoparticles, Organic (latexes), Carbon-based nanoparticles (carbon nanotubes, grapheme), Porous inorganic nanoparticles, Organic (latexes) and carbon-based nanoparticles (carbon nanotubes, grapheme)

**Nanoparticle synthesis:** Basic synthesis and fabrication methods for nanomaterials (CVD, sol-gel, microemulsion, template, hydrothermal)

**Classical Colloid Theory:** Nucleation and growth, Ostwald ripening, Homogeneous vs. heterogeneous nucleation and applications of nanomaterials, Anisotropic growth and shape control, Catalyzed (seeded) growth, Nanocrystal doping, solid solutions and Vegard's rule

**Optical characterization:** Absorption and photoluminescence (PL & PLE) spectroscopies, steady-state vs. fast spectroscopy, dynamic light scattering, Structural characterization: XRD, TEM, AFM, Deviations between bulk and near-surface crystal structures

**Chemistry of small surfaces:** Curvature and neighboring-charge effects on chemical reactivity and equilibria (pKa's, redox potentials), Applications in structural materials, lighting, energy conversion (Solar Cells) and catalysis applications, Environmental, safety, and ethical aspects of nanotechnology.

### Textbook:

G.B. Sergeev, K.J. Klabunde, Nanochemistry, Elsevier, 2013, ISBN: 978-0-444-59397-9

### References:

1. Robert Kelsall, Ian W. Hamley , Mark Geoghegan, Nanoscale Science and Technology, Wiley | 2005-04-29 | ISBN: 0470850868
2. C Brechignac, P Houdy, M Lahmani, Nanomaterials and Nanochemistry, 2011, Wiley, ISBN: 0444593977

