



UNIVERSITÀ DI PISA  
DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE  
Dottorato di Ricerca in Ingegneria dell'Informazione

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Doctoral Course

“Silicon Nanotechnology”

Prof. M. J. Sailor

*University of California San Diego – USA*

*E-mail address: msailor@ucsd.edu*

**Short Abstract:** Immersive course focussed on the synthesis, properties, and applications of silicon-based nanomaterials. Among the applications discussed there are, medical applications of silicon nanostructures, including targeted drug delivery and in vivo systems, metal and polymeric composites with porous silicon, energy related materials including Li-ion anodes and thermoelectrics, optical biosensing and chemical sensing.

**Course Contents in brief:**

Lecture	Lecture	Instrumental Concepts
1	Introduction to Porous Silicon properties and applications	
2	Semiconductor fundamentals	X-ray diffraction, 4-point probe conductivity measurement
3	Silicon electrochemistry and current-time-electrolyte relationships	Porosimetry; Gravimetry
4	Optical films and optical sensing	Optical Reflectance Spectroscopy; Spectroscopic Liquid Infiltration Method
5	Photonic crystals	
6	Quantum dots fundamentals	Photoluminescence measurements; Quantum yield
7	Silicon quantum dots	Raman spectroscopy
8	Silicon surface chemistry and characterization (1)	FTIR spectroscopy; Contact angle measurement
9	Silicon surface chemistry and characterization (2)	X-ray fluorescence, TGA/DSC
10	Biomedical applications (1): drug delivery with porous microparticles and nanoparticles	Dynamic Light Scattering; Characterization of drug release profiles
11	Biomedical applications (2): imaging and in vivo sensing with porous microparticles and nanoparticles	Time-gated photoluminescence imaging; two-photon imaging; fluorescence imaging; photoacoustic imaging
12	Metal and polymer composites	
13	Chemical and biochemical sensors	
14	Energy applications	

**Total # of hours of lecture:** 20 of hours

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### **CV of the Teacher**

Michael J. Sailor is Distinguished Professor of Chemistry and Biochemistry at the University of California, San Diego, Director of the NSF-funded [UC San Diego Materials Research Science and Engineering Center \(MRSEC\)](#), and co-Director of the UC San Diego [Institute for Materials Discovery and Design](#). He holds Affiliate Appointments in the Bioengineering, the Nanoengineering, and the Materials Science and Engineering programs at UC San Diego. Other appointments include: Invited Professor, CNRS Institut Charles Gerhardt in Montpellier, France (2012); Visiting Professor, High Level Talent Program, Key Laboratory of Organosilicon Chemistry and Material Technology, Hangzhou Normal University, China (2018-2020); and Visiting Professor, Zhejiang University, China (2019-2020).

Trained as a chemist, Sailor received a BS degree from Harvey Mudd College in 1983 and a PhD degree from Northwestern University in 1988. He began his academic career at UC San Diego in 1990, was promoted to Associate Professor in 1994, to Full Professor in 1996, and to Distinguished Professor in 2015.

He has supervised more than 160 undergraduate, graduate, and post-doctoral students at UC San Diego. He has [published](#) more than 250 peer-reviewed papers, 7 book chapters, 1 book, and he has 34 issued patents. He was named a [Highly Cited Researcher](#) by Clarivate Analytics in 2018 and in 2019. He has a citation h-index of 99 ([Google Scholar](#)).

Sailor serves on the editorial boards of the journals [Nanoscale Horizons](#), [ACS Nano](#), [Applied Physics Letters](#), and [Advanced Materials](#), and he is an Associate Editor of the journal [ACS Sensors](#). He has served on several scientific advisory boards including the United States Air Force, [Illumina](#), [Matrix Industries](#), [Nanovision Biosciences](#), [Pacific Integrated Energy](#), [TruTags](#), and [Well-Healthcare Technologies](#), and he co-founded [Spinnaker Biosciences](#), [Precis Therapeutics](#), and [Lisata Therapeutics](#).

Sailor is an elected Fellow of the American Association for the Advancement of Science, the Royal Society of Chemistry, and the National Academy of Inventors.

**Final Exam:** written test

### **Room and Schedule**

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

Schedule:

- 20/11/2023: 9:00-11:00
- 21/11/2023: 9:00-11:00
- 22/11/2023: 14:30-16:30
- 23/11/2023: 9:00-11:00
- 24/11/2023: 9:00-11:00
- 27/11/2023: 9:00-11:00
- 28/11/2023: 9:00-11:00
- 29/11/2023: 14:30-16:30
- 30/11/2023: 9:00-11:00
- 01/12/2023: 9:00-11:00