

# MATERIALS SCIENCE AND ENGINEERING (GRADUATE FIELD)

## Field Description

The focus of current advanced materials research at Cornell includes ceramics, complex fluids, metals, polymers and semiconductors in the form of thin films and in the bulk. Electrical, magnetic, mechanical, optical, and structural properties are investigated. Some special topics of interest are composites, inorganic-organic hybrids, nanocomposites, organic optoelectronics, and, in relation to the structure of materials, the investigation of grain boundaries, surfaces and structural defects. Also studied are materials synthesis and processing and solid state reactions in model systems. Many faculty are involved in electronic packaging. Numerous interactions exist with other fields at Cornell.

A strong catalyst for materials research activities at Cornell has been provided by the Cornell Center for Materials Research (formerly: Materials Science Center), which provides substantial financial assistance to graduate students and maintains central research facilities.

## Data and Statistics

- Research Master's Program Statistics (<https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/research-masters-program-statistics/?SelectGradField=31>)
- Doctoral Program Statistics (<https://gradschool.cornell.edu/about/program-metrics-assessments-and-outcomes/doctoral-program-statistics/?SelectGradField=31>)

## Field Manual

- Manual (<https://cornell.app.box.com/s/46tuwtktryk28hrpaixjfg3n47h5ea4/>)

## Subject and Degrees

### Materials Science and Engineering

- Materials Science and Engineering (MS) (<https://catalog.cornell.edu/programs/materials-science-engineering-ms/>)
- Materials Science and Engineering (PhD) (<https://catalog.cornell.edu/programs/materials-science-engineering-phd/>)

## Concentrations by Subject

### Materials Science and Engineering

- materials engineering
- materials science

## Faculty

Alireza Abbaspourrad (<http://cals.cornell.edu/alireza-abbaspourrad/>)

- **Campus:** Ithaca - (Minor Member)
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

- **Research Interests:** structural emulsions and encapsulation technologies, surface chemistry, food chemistry, ingredient technology

Nicholas Lawrence Abbott (<http://www.cheme.cornell.edu/faculty-directory/nicholas-l-abbott/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** colloidal and interfacial phenomena

Christopher Alabi (<http://www.cheme.cornell.edu/faculty-directory/christopher-alabi/>)

- **Campus:** Ithaca - (Minor Member)
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** sequence-defined oligomers, drug delivery, antibacterial agents, intracellular probes, programmable materials, change antibacterial agents to targeted antibiotics

Lynden A Archer (<http://www.cheme.cornell.edu/faculty-directory/lynden-archer/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials science
- **Research Interests:** complex fluids and polymers

C. Thomas Avedisian (<http://www.mae.cornell.edu/faculty-directory/c-thomas-avedisian/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering
- **Research Interests:** heat transfer; fluid mechanics; combustion

Shefford P Baker (<http://www.mse.cornell.edu/faculty-directory/shefford-p-baker/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering
- **Research Interests:** mechanical properties in small dimensions; micro- and nanomechanics; thin films and patterned structures; nanoindentation; microstructure and defects in materials

Carl A Batt (<http://www.bme.cornell.edu/faculty-directory/carl-batt/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** development and implementation processes for the recombinant production of therapeutic proteins; use of nanoscale materials; design and creation of novel biosensors; creation of hands-on science for young students

Nicole Ann Benedek (<http://www.mse.cornell.edu/faculty-directory/nicole-benedek/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering

- **Research Interests:** computational materials science and electronic materials

Lawrence Bonassar (<http://www.bme.cornell.edu/faculty-directory/lawrence-bonassar/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** biomaterials, materials design

Joel Donald Brock (<http://www.engineering.cornell.edu/faculty-directory/joel-donald-brock/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** time-resolved X-ray scattering of kinetic processes; in situ synchrotron X-ray scattering studies of thin-film growth; development of ultra-high-flux synchrotron radiation beamlines for real-time structural dynamics studies of materials

Judy Cha (<http://www.mse.cornell.edu/faculty-directory/judy-cha/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** Research in my lab focuses on synthesis and transport properties of topological and 2D nanomaterials and their phase transformations in order to understand the structure-electronic property relationships of quantum nanomaterials.

Itai Cohen (<http://physics.cornell.edu/itai-cohen/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials science
- **Research Interests:** Biological Physics, Experimental Condensed Matter Physics

Eve Donnelly (<http://www.engineering.cornell.edu/faculty-directory/eve-lorraine-donnelly/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** microstructure-property relationships in bone and tendon; disease and treatment; induced changes in the properties of bone mineral and collagen; connections between fundamental properties and clinical impact

Julia Dshemuchadse (<http://www.mse.cornell.edu/faculty-directory/julia-dshemuchadse/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** principles of stability and crystal structures, complex structures

Eric Robert Dufresne (<http://www.lassp.cornell.edu/people/eric-dufresne/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** Biologically-inspired and biologically-enabled materials design. Materials of life.

Amal El-Ghazaly (<http://www.ece.cornell.edu/faculty-directory/amal-el-ghazaly/>)

- **Campus:** Ithaca - (Minor Member)
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** thin-film magnetic and magnetoelectric heterostructures, large-deformation magnetoelectric elastomers

James R Engstrom (<http://www.cheme.cornell.edu/faculty-directory/james-r-engstrom/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** organic thin film transistors, where thin films of organic molecules and/or polymers provide the active (semiconducting) layer; molecular electronics, where a single molecule or a single molecular layer comprises the active layer

Lara A. Estroff (<http://www.engineering.cornell.edu/faculty-directory/lara-estroff/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials science
- **Research Interests:** bio-inspired crystal growth; biomineralization; crystal growth in hydrogels; crystal polymorph control; self-assembled monolayers

Craig J. Fennie (<http://www.engineering.cornell.edu/faculty-directory/craig-j-fennie/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** applied physics; computational material science; condensed matter physics

Gregory Fuchs (<http://physics.cornell.edu/gregory-fuchs/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** Quantum information science and spintronics

Esteban Gazel (<http://www.eas.cornell.edu/faculty-directory/esteban-gazel/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** Earth and planetary materials chemical and structural properties, high temperature diffusion and thermodynamics, critical minerals, melt and glasses properties. Mass spectrometry and Raman and IR spectroscopy.

Emmanuel P Giannelis (<http://www.mse.cornell.edu/faculty-directory/emmanuel-p-giannelis/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** polymer nanocomposites; bionanohybrids; materials for electronic packaging

Sol Michael Gruner (<http://physics.cornell.edu/sol-gruner/>)

- **Campus:** Ithaca - (Graduate School Professor)
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** biological physics; polymer and other soft condensed matter physics; X-ray and synchrotron radiation science; scientific instrumentation and technique development; development of novel X-ray detectors

Tobias Hanrath (<http://www.cheme.cornell.edu/faculty-directory/tobias-hanrath/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** optoelectronic properties; nanocrystalline semiconductors; solar energy conversion; electromechanical energy storage

Seyyed Mostafa Hassani Gangaraj (<http://www.mae.cornell.edu/mae/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** materials under extreme conditions, small scale mechanics, impact, deformation and damage mechanisms, metal additive manufacturing, solid phase processing, surface engineering

James C. Hwang (<http://www.mse.cornell.edu/faculty-directory/james-hwang/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** materials synthesis and processing, semiconductor physics and devices, nanotechnology, biomedical imaging and instrumentation, and sensors and actuators

Debdeep Jena (<http://www.ece.cornell.edu/faculty-directory/debdeep-jena/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** electronic materials and devices

Shaoyi Jiang (<http://www.bme.cornell.edu/faculty-directory/shaoyi-jiang/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

- **Research Interests:** Molecular understanding, design and development of biomedical and materials and materials for engineering applications for viral and non-viral drug delivery carriers, implant materials, anticoagulant-free blood contacting devices, controlled cell differentiation/expansion/preservation, and marine coatings.

John A Marohn (<http://chemistry.cornell.edu/john-marohn/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** characterization of electronic materials; nanoscale magnetic resonance imaging; scanning probe microscopy

Matthew Peter Miller (<http://www.mae.cornell.edu/faculty-directory/matthew-peter-miller/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering
- **Research Interests:** processing and properties of engineering materials, primarily alloys; integrated characterization experiments and mechanical tests with multiscale numerical simulations to better understand structure/property relationships and to develop all performance prediction methodologies

Atieh Moridi (<http://www.mae.cornell.edu/faculty-directory/atieh-moridi/>)

- **Campus:** Ithaca - (Minor Member)
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** metal additive manufacturing

David A. Muller (<http://www.aep.cornell.edu/faculty-directory/david-anthony-muller/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** impact of electronic structural changes on small-length scales and how they affect macroscopic properties of materials; how interfaces affect transport properties; role of electronic structure in controlling cohesion of interfaces; first detection/real-space characterization of individual atoms and how clusters vary inside crystals

Hari P Nair (<http://www.mse.cornell.edu/faculty-directory/hari-nair/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** oxide epitaxial thin films for applications ranging from power electronics to optical metamaterials

Sriramya Nair (<http://www.engineering.cornell.edu/faculty-directory/sriramya-duddukuri-nair/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

- **Research Interests:** sustainable construction materials for subsurface and above ground infrastructure applications.

Christopher Kemper Ober (<http://www.mse.cornell.edu/faculty-directory/christopher-k-ober/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** polymer synthesis - liquid crystals, thermosets, fluorinated polymers; polymer characterization - real-time x-ray diffraction; materials for microelectronics - resists and adhesives

Richard D. Robinson (<http://www.engineering.cornell.edu/faculty-directory/richard-douglas-robinson/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** nanoparticle science and energy applications of nanoscale materials; synthesis and characterization of new metal and metal oxide particles; the creation of advanced alternative energy devices that make use of nanoparticles

Darrell G. Schlom (<http://www.mse.cornell.edu/faculty-directory/darrell-schlom/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** heteroepitaxial growth and characterization of oxide thin films, especially ferroelectric and multiferroic oxides on semiconductors for increased functionality or as potential replacements for silicon oxide as the gate dielectric in MOSFETs

Robert Shepherd (<http://www.mae.cornell.edu/faculty-directory/robert-f-shepherd/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

Meredith Silberstein (<http://www.engineering.cornell.edu/faculty-directory/meredith-silberstein/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

Andrej Singer (<http://www.engineering.cornell.edu/faculty-directory/andrej-singer/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

Jin Suntivich (<http://www.mse.cornell.edu/faculty-directory/jin-suntivich/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science

Michael Olgar Thompson (<http://www.mse.cornell.edu/faculty-directory/michael-thompson/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** electronic properties of thin layers; point defect diffusion in semiconductors; interface stability and nonequilibrium growth properties

Zhiting Tian (<http://ztgroup.org/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** thermal materials, heat transfer, materials science, condensed matter physics, nanoengineering

Christopher (Kit) Cutler Umbach (<http://www.mse.cornell.edu/faculty-directory/christopher-cutler-umbach/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering
- **Research Interests:** surface characterization of thin films and glasses using x-ray scattering and scanned probe microscopy; nanopatterning of surfaces

Tamer Uyar (<http://www.human.cornell.edu/people/tu46/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** -development of nanofibers via electrospinning and functional fiber/textile materials -understanding the fiber formation of materials -develop functional fibrous materials

Robert Bruce van Dover (<http://www.mse.cornell.edu/faculty-directory/r-b-van-dover/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** growth and properties of magnetic, dielectric, superconducting and optical thin films; fabrication and characterization of thin film devices; properties of magnetic and superconducting ceramics; development and use of high throughput synthesis/evaluation experimental strategies

Krystyn J Van Vliet (<http://www.engineering.cornell.edu/faculty-directory/krystyn-van-vliet/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering:* materials engineering; materials science
- **Research Interests:** Materials Science and Engineering and Biomedical Engineering

Chekesha M. Watson (<http://www.mse.cornell.edu/faculty-directory/chekesha-m-watson/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** colloidal building blocks for three-dimensional photonic crystals, design and synthesis of colloids for environmental remediation strategies, mesoscale assembly techniques, colloid separations technology, hierarchical inorganic and hybrid bio-inspired materials, inorganic mesoporous materials

Ulrich Bernd Wiesner (<http://www.engineering.cornell.edu/faculty-directory/uli-b-wiesner/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials science
- **Research Interests:** polymer science; block copolymers; ionomers; complex fluids under shear; polymer materials at the interface with ceramics and nanobiotechnology

Huili (Grace) Xing (<http://www.ece.cornell.edu/faculty-directory/huili-grace-xing/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** electronic materials and devices

Rong Yang (<http://www.cheme.cornell.edu/faculty-directory/rong-yang/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** Materials Science and Engineering

Jingjie Yeo (<http://www.mae.cornell.edu/faculty-directory/jingjie-yeo/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** Low cost soft, adaptive, and responsive biomaterials for drugs and drug delivery to combat issues caused by the rapid aging of the global human population.

Qiuming Yu (<http://www.cheme.cornell.edu/faculty-directory/qiuming-yu/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** Optoelectronic materials and devices and plasmonic biosensors

Shuwen Yue (<http://www.cheme.cornell.edu/faculty-directory/shuwen-yue/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials engineering; materials science
- **Research Interests:** Our group works at the interface of molecular simulation, machine-learning, statistical mechanics, and quantum mechanics towards the design of novel electrolytes and materials for energy and sustainability.

Yu Zhong (<http://www.mse.cornell.edu/faculty-directory/yu-zhong/>)

- **Campus:** Ithaca
- **Concentrations:** *Materials Science and Engineering*: materials science
- **Research Interests:** Materials Science