



Stanford University

Department of Materials Science and Engineering

<http://mse.stanford.edu/>

PHILOSOPHY

The Department of Materials Science and Engineering concentrates on the relationship between the structure and properties of materials and the fabrication of advanced materials with novel structures and special mechanical, electrical, optical and magnetic properties. Since expertise from the fields of metallurgy, ceramics, polymer science, chemistry and solid-state physics is needed to make and understand advanced materials, research is done in interdisciplinary teams within the department and in collaboration with scientists and engineers from other departments at Stanford and institutions outside Stanford University.

RESEARCH FACILITIES

The Thomas F. Peterson Engineering Laboratory houses equipment for optical, scanning, and transmission electron microscopy, x-ray diffraction, metallography, wet chemistry, mechanical testing of bulk and thin film materials, UHV sputter deposition, electrical and magnetic measurements, vacuum annealing treatments and metal forming. The Geballe Laboratory for Advanced Materials (McCullough and Moore Buildings) houses equipment for electrical, magnetic and optical characterization, fabrication of metalorganic chemical vapor disposition, bulk crystal growth, scanning probe microscopy, scanning electron microscopy, transmission electron microscopy, electron microprobe analysis, x-ray photoelectron spectroscopy, and x-ray diffraction. The Center for Research on Information Storage Materials (CRISM) is also located in the McCullough Building. Students frequently use the Stanford Synchrotron Laboratory (SSRL), the clean room facilities in the Center of Integrated Systems (CIS) and the labs of collaborators in other departments at Stanford University.

PROGRAMS OF STUDY

Students can earn a Bachelor of Science, a coterminial BS/MS, a Master of Science, Engineer, or Doctor of Philosophy degree. In a typical year there are approximately 10 undergraduate and 150 graduate students. The high number of graduate students reflects the emphasis that the department has on research. Most students are advised by one of the professors with a primary appointment in the department or the professors who have courtesy appointments in the department. A few students are advised by some of the more than 60 professors who do materials research in other departments at Stanford University. Many students collaborate with these professors, who are part of a very strong community studying materials science and engineering at Stanford.

FINANCIAL AID

Department aid may take the form of School of Engineering Fellowships, Stanford Graduate Fellowships, or Research Assistantships. We strongly encourage applicants to apply for outside fellowships such as Hertz, NSF, NDSEG, etc. or appropriate fellowships offered by their country. Aid packages are determined separately by the Financial Aid Committee in conjunction with the Admissions Committee. Research Assistantship funding is more often provided to students further along in their studies.

APPLYING

Students are normally admitted to begin in the Autumn quarter only. Applicants should see that completed applications are received by the department by the early January deadline. The GRE General Test must be taken early enough to allow the scores to be reported to the department by the application deadlines. The Test of English as a Foreign Language (TOEFL) is required by the University for all students from countries where English is not the native language

THE UNIVERSITY

Stanford University was founded in 1885 by Senator and Mrs. Leland Stanford and has an international reputation as an outstanding educational institution. Stanford has a long-standing tradition of academic excellence in the engineering and physical science fields, producing many prominent engineers and scientists. The atmosphere of the University is an unusual blend of a pleasant and uncrowded environment, a dynamic and diverse student body and faculty, and unswerving standards of academic excellence.

The Faculty and Their Areas of Research

David M. Barnett, Professor - Materials Science and Engineering and Mechanical Engineering; [Ph.D. (Materials Science), Stanford University, 1967.] Dislocation mechanics, elastic waves in anisotropic solids.
(650) 723-4143, Building 550, Room 550K, E-Mail: barnett@leland.stanford.edu

Arthur I. Bienenstock, Professor - Applied Physics and Materials Science and Engineering; [Ph.D. (Applied Physics), Harvard University, 1962.] Diffraction phenomena, amorphous solids and synchrotron radiation.
(202) 456-6130, Building 550, Room 553C, E-Mail: arthur_bienenstock@oa.eop.gov

John C. Bravman, Vice Provost of Undergraduate Education, Bing Centennial Professor, - Materials Science and Engineering, Chair Center for Materials Research, Dean of Freshman Sophomore College; [Ph.D. (Materials Science & Engineering), Stanford University, 1985.] Semiconductor materials processing, thin film mechanical properties.
(650) 723-3698, Building 550, Room 550I, E-Mail: bravman@stanford.edu

Mark L. Brongersma, Assistant Professor - Materials Science and Engineering; [Ph.D. (Materials Science), FOM Institute, The Netherlands, 1998]. Nanoscale electronics and photonics, explores materials and structures for use in nanoelectronic and nanophotonic devices, development and design of nanoparticle based memories and subwavelength-scale waveguides.
(650) 723-0698, McCullough Building, E-Mail: brongersma@stanford.edu

Bruce M. Clemens, Professor - Materials Science and Engineering; [Ph.D. (Applied Physics), California Institute of Technology, 1982.] Metal thin films, superlattices, interfaces, interface reactions, metastable phases, magnetic materials, x-ray diffraction.
(650) 725-7455, Building 550, Room 551B, E-Mail: clemens@soe.stanford.edu

Reinhold H. Dauskardt, Associate Chair, Professor - Materials Science and Engineering; [Ph.D. (Materials Science), Combined: UC-Berkeley & Wits University (South Africa), 1988.] Microstructure and mechanical behavior of materials. Fracture, fatigue, and environmentally-assisted failure in metals, ceramics, composites and bio-materials.
(650) 725-0679, Building 550, Room 550G, E-Mail: dauskardt@stanford.edu

Michael D. McGehee, Assistant Professor - Materials Science and Engineering; [Ph.D. (Materials Science), University of California–Santa Barbara, 1999.] The electrical and optical properties of nanocomposites made of semiconducting polymers, rare earth complexes, nanowires, and self-assembled mesoporous metal oxides. The incorporation of light-emitting polymers into photonic crystals.
(650) 736-0307, McCullough Building, Room 215, E-Mail: mmcgehee@stanford.edu

Paul McIntyre, Assistant Professor - Materials Science and Engineering; [Sc.D. (Ceramics) Massachusetts Institute of Technology, 1993.] Diffusion, chemical reactions, and phase transitions in thin films and coating; materials processing; ceramics.
(650) 725-9806, McCullough Building, Room 243, E-Mail: pcm1@leland.stanford.edu

Nicholas A. Melosh, Assistant Professor - Materials Science and Engineering; [Ph.D. (Materials Science), UC Santa Barbara, 2001]. Molecular characterization and actuation based on nanoscale components. Device structures for biomolecular detection, molecular electronics and dynamic control of self-assembly.
(650) 724-3679, McCullough Building, Room 223, E-Mail: nmelosh@stanford.edu

Friedrich B. Prinz, Professor - Mechanical Engineering and Materials Science and Engineering, Rodney H. Adams Professor of Engineering; [Ph.D. (Physics), University of Vienna - Austria, 1975.] Rapid prototyping via thermal spray deposition, geometric modeling, manufacturing systems.
(650) 723-0084, Building 530, Room 220, E-Mail: fbp@cdr.stanford.edu

Robert Sinclair, Chair, Professor - Materials Science and Engineering; [Ph.D. (Materials Science), Cambridge University, 1972.] High resolution electron microscopy, interface structure and phase reactions in solids, magnetic materials.
(650) 723-1102, Building 550, Room 550L, E-Mail: bobsinc@leland.stanford.edu

Shan X. Wang, Associate Professor - Electrical Engineering and Materials Science and Engineering, Director - Center for Research on Information Storage Materials; [Ph.D. (Electrical Engineering), Carnegie-Mellon University, 1993.] Growth and characterization of magnetic materials. Design and fabrication of devices for information storage.
(650) 723-8671, McCullough Building, Room 351, E-Mail: swang@ee.stanford.edu

Professors by Courtesy

Stacey Bent, Associate Professor Chemical Engineering and by Courtesy Materials Science and Engineering, by Courtesy Chemistry, by Courtesy Electrical Engineering; [Ph.D. (Chemistry), Stanford University, 1992.] Semiconductor Processing and surface reactivity, modification of semiconductor surfaces, scanning tunneling microscopy of organic monolayers, amorphous semiconductors, probing radicals in materials processing, microcontact printing for retinal implantation.

(650) 723-0385, Stauffer III Building, Room 215, E-Mail: Stacey@chemeng.stanford.edu

Kyeongjae (KJ) Cho, Assistant Professor - Mechanical Engineering and by Courtesy Materials Science and Engineering; [Ph.D. (Physics), MIT, 1994.] Multiscale simulation and modeling of nanoscale engineering systems, electronic materials modeling, computational nanotechnology, multiscale simulations, ab initio cell mechanics, molecular dynamics study of proteins, biomembranes.

(650) 723-4354, Durand Building, Room 257, E-Mail: kjcho@stanford.edu, www-mc.stanford.edu/chogroup.

Ian Fisher, Assistant Professor – Applied Physics and by Courtesy, Materials Science and Engineering; [Ph.D. (Physics), University of Cambridge, UK, 1996.] Magnetism and correlated electrons in new or exotic materials. Focus on the design, growth and characterization of single crystals and quasicrystals to enable the study of various magnetic and electronic ground states and phase transitions. Particular interest in designing systems that preserve at least some magnetic entropy to low temperatures.

(650) 723-5821, McCullough Building, Room 359, E-Mail: irfisher@stanford.edu

Curtis W. Frank, Professor - Chemical Engineering and by Courtesy, Materials Science and Engineering; [Ph.D. (Chemical Engineering), University of Illinois, 1972.] Polymer physics and interface science, ultrathin organic films, polymer photophysics.

(650) 723-4573, Stauffer III Building, Room 105, E-Mail: curt.frank@stanford.edu

James S. Harris, Professor - Electrical Engineering and by Courtesy, Materials Science and Engineering, James and Eleanor Chesebrough Professor of Engineering, Director of the Solid State Labs; [Ph.D. (Electrical Engineering), Stanford University, 1969.] Molecular beam epitaxy and quantum well structures for electronic, optoelectronic and non-linear optical devices.

(650) 723-9775, CIS-X Building, Room 328, E-Mail: harris@ee.stanford.edu

Harindran Manoharan, Assistant Professor - Physics and by Courtesy, Materials Science and Engineering; [Ph.D. (Electrical Engineering), Princeton University, 1997.] Nanoassembly using atomic and molecular manipulation, studies of isolated and interacting magnetic moments, local probes of correlated electrons in reduced dimensions, local response of novel superconductors, exploring new paradigms in computation, atomic and molecular electronics, organic molecules and life structure.

(650) 723-7263, McCullough Building, Room 348, E-Mail: hari@physics.stanford.edu

James D. Plummer, Professor - Electrical Engineering and by Courtesy to Materials Science and Engineering, John M. Fluke Professor, Director - Stanford Nanofabrication Facility; [Ph.D. (Electrical Engineering), Stanford University, 1971.] Semiconductor materials and devices, primarily silicon. Computer modeling of fabrication technology and device physics.

(650) 725-3606, CIS-X Building, Room 330, E-Mail: plummer@ee.stanford.edu

Jonathan F. Stebbins, Professor - Geological and Environmental Sciences and by Courtesy, Materials Science and Engineering, Associate Dean for Academic Affairs - School of Earth Sciences; [Ph.D. (Geology), University of California - Berkeley, 1983.] Nuclear magnetic resonance, structure and dynamics of oxide liquids, glasses, and crystals.

(650) 723-1140, Green Earth Sciences Building, Room 259, E-Mail: stebbins@pangea.stanford.edu

Joachim Stohr, Professor - Stanford Synchrotron Radiation Laboratory and by Courtesy, Materials Science and Engineering; Deputy Director - Stanford Synchrotron Radiation Laboratory; [Ph.D. (Physics), Tech. Univ. München – 1974.] Exchange bias, spin injection, ultrafast switching, development of coherent x-ray diffraction (speckle) for the study of nanoscale spin dynamics.

(650) 926-2570, SLAC/SSRL, E-Mail: stohr@slac.stanford.edu

Active Emeritus Professors

Richard H. Bube, Professor Emeritus - Materials Science and Engineering and Electrical Engineering; [Ph.D. (Physics), Princeton University, 1950.] Photoelectronic and photovoltaic materials and devices.

(650) 723-2535, Building 550, Room 554D, E-Mail: bube@leland.stanford.edu

Robert S. Feigelson, Professor Emeritus (Research) - Materials Science and Engineering; [Ph.D. (Materials Science & Engineering), Stanford University, 1974.] Crystal growth of biological, electronic, optical, and superconducting materials.

(650) 723-4007, McCullough Building, E-Mail: feigel@soe.stanford.edu

Theodore H. Geballe, Professor Emeritus - Materials Science and Engineering and Applied Physics; [Ph.D. (Physical Chemistry), University of California at Berkeley, 1949.] Condensed matter, and superconducting and magnetic oxides.
(650) 723-0215, McCullough Building, Room 358, E-Mail: geballe@stanford.edu

Stig B. Hagstrom, Professor Emeritus - Materials Science and Engineering; [Ph.D. (Physics), University of Uppsala, Sweden, 1961.] Surface sciences using electron spectroscopy, thin film deposition processes.
(650) 723-2617, Building 550, Room 551G, E-Mail: hagstrom@stanford.edu

William D. Nix, Professor Emeritus - Materials Science and Engineering, Lee Otterson Professor of Engineering; [Ph.D. (Materials Science), Stanford University, 1963.] Dislocation mechanics, mechanical behavior of solids in bulk and thin film form.
(650) 725-2605, Building 550, Room 550H, E-Mail: nix@soe.stanford.edu

Robert L. White, Professor Emeritus - Electrical Engineering and Materials Science and Engineering; [Ph.D. (Physics), Columbia University, 1954.] Magnetism, especially thin films and multilayers, origins of magnetic anisotropy, magneto-transport properties such as magnetoresistance and giant magnetoresistance, magnetic media for data storage, especially lithographically patterned media, influence of microstructure in thin films upon magnetic properties.
(650) 723-4431, McCullough Building, Room 341, E-Mail: white@ee.stanford.edu

Consulting Faculty

Paul A. Flinn, Consulting Professor; [Sc.D. (Physics), Massachusetts Institute of Technology, 1952.] Mechanical properties of microelectronic thin film materials. New methods for the measurement of stresses and mechanical properties of thin films.
(650) 723-7160, Building 550, Room 555E (at Stanford), or (408) 765-2937 (at Intel Corp.), E-Mail: flinn@soe.stanford.edu

Timur Halicioglu, Consulting Professor; [Ph.D. (Chemistry), Yale University, 1968.] Computer simulation and modeling of interfacial and surface phenomena.
(650) 725-4034, Building 550, Room 555M, E-Mail: haliciog@stanford.edu

Michael A. Kelly, Consulting Professor; [Ph.D. (Physics), University of California - Berkeley, 1968.] Thin film synthesis and surface analytical techniques, XPS measurements.
(650) 723-2617, Building 550, Room 556U, E-Mail: mkelly@stanford.edu

Jamshed R. Patel, Consulting Professor; [Sc.D. (Physics) Massachusetts Institute of Technology. 1954.] X-Ray micro analysis.
(650) 725-2640, Building 550, Room 550J, E-mail: jrpatel@stanford.edu

Baylor Triplett, Consulting Professor, [Ph.D. (Chemistry), University of California at Berkeley, 1970]. Development of new materials to replace SiO₂ based gate dielectrics in silicon ULSI, microcontamination, new proprietary metrologies to detect contamination induced defects.

Robert M. White, Consulting Professor; [Ph.D. (Physics), Stanford University, 1964] Research on magnetic random access memory (MRAM).