Georgia Tech Library Collection Development Policy (Draft)

School of Materials Science & Engineering
2004

Collection Development Objectives

The Library & Information Center at Georgia Institute of Technology supports faculty and student research and the curriculum through doctoral degree level in the discipline of Materials Science & Engineering; it also supports research projects and programs conducted on behalf of faculty researchers, research engineers, and research scientists in the School's various laboratories and research centers.

School Profile -- Overview

The School of Materials Science & Engineering is one of nine schools in the College of Engineering.

Faculty Profile of the School of Material Science & Engineering

Title	Number	Note
Regents' Professor	3	Primary faculty member
Professor	11	Primary faculty member
Associate Professor	5	Primary faculty member
Assistant Professor	2	Primary faculty member
Academic Professional	1	Primary faculty member
Research Scientist	1	Primary faculty member
Emeritus Professor	3	N/A
Jointly Appointed Professor	9	One with BME, one with ECE, one with EE, 3 with ME, and 3 with Chemistry & Biochemistry department.
Principal Research Engineer	2	N/A
Adjunct Faculty	5	One from Sandia National Laboratories, one from IPST, one from Georgia Tech Research Institute, and one from University of Arkansas.

School Chair

Robert L. Snyder

Professor & Chair

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Group Email Address

None

School Web Site

http://www.mse.gatech.edu/

Library Committee or Chair

None

Professional Accreditation

The School is accredited by the Accreditation Board for Engineering and Technology (ABET).

School Profile – Curriculum

Enrollment

Enrollment	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Undergraduate	70	85	70	57	49	42	51	48	70	n/a
Graduate	36	22	34	54	75	68	74	83	108	n/a

Data from the Georgia Institute of Technology 2003 Fact Book, *tables 4.17, 4.18.*

Degrees offered

Bachelor Degree -- B.S.	Master Degree -- M.S.	Five-Year B.S.-M.S. Program	Doctoral Degree -- Ph.D.	Undergraduate Certificates	Other
Material Science and Engineering	Material Science and Engineering	Material Science and Engineering	Material Science and Engineering	Biomaterials Certificate Program	Undergraduate Minor in Materials Science
	Polymers (Interdisciplinary Program)		Polymers (Interdisciplinary Program)	Composites Certificate Program	
	Bioengineering (Interdisciplinary Program)		Bioengineering (Interdisciplinary Program)	Nanomaterials Certificate Program	
	Biomedical Engineering (Interdisciplinary Program)		Biomedical Engineering (Interdisciplinary Program)		

Undergraduate Program Educational Objectives: The educational objectives of the Bachelor of Science in Materials Science and engineering program are to produce graduates who:

- are of high quality;
- are able to apply the fundamentals of mathematics and physical sciences to engineering problems;

- are knowledgeable about processing-structure-property relationships in engineering materials such as metals, ceramics, polymers, electronic materials, composites, and biomaterials;
- are able to identify and define problems (including design problems), develop and evaluate economically feasible alternative solutions from diverse knowledge bases, and implement an acceptable solution;
- are able to communicate and contribute effectively while working in multidisciplinary teams;
- are adept at using computers for analysis, design, and communication;
- understand their professional and ethical responsibility to society in a global context; and
- understand the importance of lifelong learning and have the skills to pursue it.

Degrees Awarded

Degrees	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Bachelors (Materials Engineering)	21	19	16	25	19	15	-	-	-	n/a
Bachelors (Materials Science & Engineering)	-	-	-	-	-	-	7	9	11	n/a
Masters	0	2	2	8	22	14	9	17	10	n/a
PhD	-	-	-	1	8	9	8	6	5	n/a

Data from the Georgia Institute of Technology 2003 Fact Book, *tables 5.6, 5.7. 5.8.*

General Education Course Responsibility (if applicable)

None

School Profile -- Research

Major Faculty Research Interests

Research in the School of Materials Science and Engineering at Georgia Tech spans through all classes of materials, including metals, ceramics, polymers, composites, biomaterials, electronic, superconducting, and photonic and magnetic materials, highlighting the following areas:

- synthesis and processing focusing on development of advanced materials with novel compositions and tailored microstructures
- characterization and evaluation of structure and properties using advanced techniques and state-of-the-art instrumentation
- modeling of structure-property-performance relationships emphasizing correlation of properties with the structure across nano, micro, meso, and macro length scales

Some major externally funded research programs are:

Biomaterials -Materials used for orthopedic implants, dental restorations and appliances, and other medical and dental applications, must meet very strict requirements of biocompatibility, corrosion resistance, and specific physical properties. Studies in this field have been performed in the areas of dental amalgam, corrosion of implants, fracture and fatigue of implant materials, release of metallic ions into the body fluids, and simultaneous effects of corrosion and stress.

Ceramics and Ceramic-matrix Composites Processing -Synthesis, processing, and characterization of ceramics and ceramic-composites for structural, electronic, and optical

applications, is being pursued via: (i) Chemical methods for solution-precipitation synthesis of submicron particles with controlled morphology, and processing of fibers and films using sol-gel and pre-ceramic polymer methods; (ii) Processing of powder/fluid systems, including investigations of the effects of processing variables on dispersion and wetting behavior, rheological properties, and the consolidated structure of powder compacts; and (iii) Thermal processing, including investigations of thermal decomposition of polymers and ceramic precursors, densification/sintering behavior and microstructure evolution, and methods for controlling microstructure development.

Ceramic Coatings -A novel, proprietary chemical vapor deposition (CVD) process for applying oxide ceramic coatings to solid substrates is being developed.

High Performance Ceramics Synthesis -Research was begun in 1983 to develop a low-cost ceramic as a high performance, impact resistant material using advanced synthesis and processing technology.

High Strain Rate Deformation and Synthesis -Research in this area is focused on three topics: (a) synthesis and processing of materials by combined shock-compression, combustion reactions, and mechanical alloying; (b) structural and chemical changes in materials forming high-pressure crystalline and amorphous phases; and (c) deformation and fracture behavior of multi-phase ceramics under impact loading.

Hollow Metal Sphere Foams -Structural foams, formed to near-net-shape by bonding hollow metal spheres at points of contact, offer the possibility of strong, light-weight, reasonably priced materials for use in rigid and energy absorbing systems for aerospace and automotive vehicles.

Low Voltage Field Emission Display (FED) Phosphors - The research includes new surface modifications, treatments and coating techniques for improving the low voltage luminance and efficiency and the long term stability characteristics of phosphors for field emission displays and plasma displays.

Mechanical Behavior of Materials -Models for predicting the fatigue, fracture and deformation behavior of a variety of metallic and composite materials and structural components are being developed as part of this ongoing research. A major focus is on developing the constitutive response, fatigue, fracture and creep behavior of high temperature materials used in jet engines, helicopter rotors, structures for high speed civil transport (HSCT) and power-plants.

Molecular Design of Functional Materials -Molecular design and synthesis of materials is being conducted in the Molecular Design Institute (MDI). MDI aims to design and construct nanometer and sub-nanometer size building units into ordered arrays, and functionalize the resultant products.

Nanophase and Nanostructured Materials -The objectives of this research are to synthesize and characterize nanocrystal engineered superlattices, to prepare mesoporous nanostructured materials with large surface areas, to characterize the structural and chemical evolution behavior of the nanocrystals, and to measure the physical properties of individual nanostructures, such as the electric quantum conductance and mechanical properties of a single carbon nanotube.

Novel Transmission Electron Microscopy Techniques -Transmission electron microscopy and associated analytical techniques (such as electron energy-loss spectroscopy and energy-filtering) are powerful tools for quantitative determination the crystallographic and chemical structures of advanced materials. This research involves the exploration of novel techniques of applying TEM for analysis of smart materials, aiming at understanding the structure-property relationships.

Polymer Bonding Materials for Low-cost Chip Packaging -Novel reworkable, fast-curing, high performance wafer level underfill materials are being developed to significantly reduce processing time and cut material costs.

Porous Materials for Microelectronic Device -Research on the processing and characterization of porous materials is focused on their application in microelectronics devices.

Quantitative Microstructural Analysis -A current thrust in materials research is towards quantitative and precise descriptions of materials processes. Accordingly, the microstructure-properties-processing investigations are becoming increasingly quantitative. An important input for such research efforts is unbiased and quantitative characterization of microstructure and microstructural evolution.

Soft Condensed Matter and Self-Assembly -This research avenue will provide a methodical, comprehensive understanding of the bonding-structure-function relationship in multi-component, metal-polymer nanostructure, and it will pave the way for applications in the area of optical, biomedical and electronic devices.

Solid-Oxide Fuel Cells -The processing and properties of a variety of potentially useful materials are being investigated in this research.

Solidification and Materials Fabrication -Major gains in the understanding of the behavior of materials come about as a consequence of our ability to alter the microstructure in a systematic fashion.

Thin-film Opto-electronic Materials -The thin film research program is directed to the growth of materials such as ZnS, SrS, and CaS for developing new opto-electronic materials and device structures that can be integrated with silicon and, also, for supporting the development of full color electroluminescent materials.

X-ray Micro-tomographic Microdiffraction -X-ray micro-tomographic is a very high resolution version of the familiar medical CAT-scanners. Both techniques rely on recombining radiographs recorded from many viewing directions to map the interior structure of cross-sectional slices of a sample. The principal difference is that microtomography is specifically designed for spatial resolution approaching that of optical microscopy (i.e., 1 μm) whereas medical systems are designed for resolving millimeter-sized structures. The ability of microtomography to observe the internal microstructure of samples repeatedly during the course of an experiment produces new insight into the processing-structure-property relationship in monolithic and composite samples.

New and Expanding Areas of Interest [if applicable]

None

Research Centers [if applicable]

- Center for Nanoscience and Nanotechnology
- Composite Education and Research Center (CERC)
- Electron Microscopy Center (EMC)
- The Georgia Tech Materials Council
- Manufacturing Research Center
- Mechanical Properties Research Laboratories (MPRL)
- Microelectronics Research Center
- MURI on Intelligent Luminescence for Communication, Display and Identification

- Molecular Design Institute (MDI)
- Packaging Research Center (PRC)
- Phosphor Technology Center of Excellence (PTCOE)
- Polymer Education and Research Center (PERC)

Collection Development Responsibility [to be discussed in July 2004]

Classed Analysis (based on Library of Congress classifications) [to be discussed in fall 2004]