Tuskegee University
College of Engineering
Doctor of Philosophy (Ph.D.) in Materials Science and Engineering

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Degrees Offered: Doctor of Philosophy (Ph.D.) in Materials Science and Engineering, Dissertation

The Department of Materials Science and Engineering at Tuskegee University produces graduates who can be successful in industry and national laboratories. We have assembled a multidisciplinary group of faculty members with expertise in various aspects of synthesis, processing, modeling and characterization of advanced materials that may be used for military, industrial, agricultural and healthcare applications.

* For additional information please refer to the Graduate Handbook.

Admission Requirements

Applicants must have a Master's degree in Materials Science and Engineering or related disciplines from college or university to be considered for the Ph.D. program in Materials Science and Engineering
Prerequisite academic work should provide evidence that the application shall be able to pursue the graduate course effectively
Applicants must also have a cumulative GPA of 3.0 or better.
The minimum acceptable combined GRE score is 1000 (old) or 300 (new).
Official Transcript from all colleges/universities attended (International Students must have transcripts translated through World Education Services -WES)
Completed Application along with the required amount of application fees
3 Letters of Recommendation
Statement of Purpose
GRE Scores
Financial Affidavit (International Students –only)
Test of English as Foreign Language (TOEFL) Scores (International students only)

Advisory Committee

During the first year of his/her study in the Ph.D. program, the student and his/her Major Professor must recommend to the Head of the Department the student's Advisory Committee consisting of a minimum of six members including the Major Professor, the Head of the Department and two members from outside of Tuskegee University for approval. The Advisory Committee shall also serve as the Examination Committee.

Core Courses (12 credits): Required for All Students in the Ph.D. program

MSEG 0601: Physics of Materials – 3credits
MSEG 0603: Polymer Physics – 3 credits
MSEG 0604: Materials Properties and Characterization – 3 credits
MSEG 0605: Ethics in Research – 1 credit
MSEG 0606: Literature Search and Technical Writing – 2 credits

Elective Courses (6 credits): Determined by Student's Major Professor

Elective courses may be any Ph.D. level courses offered at Tuskegee University or elsewhere. Approval of the Major Professor is necessary for a student to sign up for electives.

Transfer Credits

The student's Advisory Committee may recommend transfer credits for graduate courses taken by the student at any other institution. Transfer credits may be recommended under both core and elective categories.

MSEG 0800	**Research.** CR. 24.
	List of Elective Courses
MSEG 0601	**PHYSICS OF MATERIALS**. CR. 3. To gain an understanding of the nature of materials based on the physical principles on which the properties of materials depend. The basic relationships introduced in undergraduate physics and chemistry courses are extended using the concepts of quantum mechanics to relate the properties of materials to their internal structure and external environment. Optical, electrical, thermal and magnetic properties of metals, semiconductors and insulators will be covered.
MSEG 0603	**POLYMER PHYSICS**. CR. 3. Principles of polymer physics will taught. Emphasis is placed on classification of polymers, molecular sizes, polymer blends, morphology, time-independent elasticity, linear viscoelasticity and yield, and yield and fracture polymers**.**
MSEG 0604	**MATERIALS PROPERTIES AND CHARACTERIZATION**. CR. 3. A multidisciplinary course offering a practical hands-on experience with various analytical equipment and analysis of advanced composite materials including nanomaterials. Focus on sample preparation, principles and applications of various microscopy, thermal and mechanical methods. Covered topics include AFM, SEM, TEM, EDX, X-ray, TGA, DSC, DMA, TMA, tensile, compression and flexure tests.
MSEG 0605	**RESEARCH ETHICS**. CR. 1. The course will provide students an understanding of ethical issues in scientific research. Moral complexities in the engineering profession will be highlighted. Case studies will be used to illustrate how to analyze and resolve identified ethical issues.
MSEG 0606	**LITERATURE SEARCH AND TECHNICAL WRITING**. Cr. 2. To prepare the MSEG Ph.D. and MS candidates for writing professional papers, making presentations, and preparing theses/dissertations. To accomplish this objective, the literature related to material science and engineering is surveyed. The tools for searching the material science and engineering literature are explored. The instructors will critically analyze abstracts, formal papers and theses/dissertations related writings prepared by the students.
MSEG 0607	**PROPOSAL DEVELOPMENT**. Cr. 3. In this course emphasis will be placed on technical research proposal writing. Focus will be placed on solicitation search, critical review of the literature on the research subject, development of the proposed research idea, highlights of the proposed research innovation, development of research work plans and tasks, projected outcome and deliverables, and cost proposal development.
MSEG 0610	**Advanced Materials Science and Engineering.** Cr. 3. This course introduces students coming from various disciplines to materials science and engineering. Different types of advanced materials, modern material needs, processing techniques, properties and application will be discussed. Material degradation upon exposure to various environments, proper selection of material and design consideration, economic and recycling issues of materials will be taught. ***Prerequisite: MENG 0318: Materials Engineering***
MSEG 0611	**MOLECULAR MODELING OF POLYMERS AND NANOCOMPOSITES**. Cr. 3. To introduce students to the fundamentals of molecular modeling and to put that knowledge to use in a class project. Mini-projects and homework sets will be assigned as needed. Mini-projects require computer calculations. Homework sets will be drawn from the text and from literature sources.
MSEG 0612	

	diffusion, atomic theory of diffusion kirkendall effect, Darken equations, high diffusivity phenomenon and chemical reaction kinetics, pertinent to transformations.
MSEG 0623	**THEORY OF ELASTICITY**. CR. 3. Stress-Strain relations, strain energy, general methods of elasticity, reciprocal theorems, energy methods and variational principles. The Rayleigh-Ritz and Galerkin methods. Finite difference and relaxation method. Tensor application. ***Prerequisites: MENG 0416 and MATH 0461. Graduate Standing.***
MSEG 0624	**POLYMER CHEMISTRY**. CR. 3. A survey course on polymeric materials. Areas covered are the synthesis and reactions of polymers, thermodynamics and kinetics of polymerization, the physical characterization of polymers and the fabrication, testing and uses of polymers. These topics are integrated into both the lecture and the laboratory. ***Prerequisites: Organic Chemistry 321 & 323; Physical Chemistry 402 & 404***
MSEG 0625	**THERMODYNAMICS OF MATERIALS SYSTEMS**. CR. 3. The laws of thermodynamics applied to the stability of material phases, crystal imperfections, solubility, oxidation, surface and interface energy, and transformation. Application of the laws of Thermodynamics to Material Systems: chemical reactions, phase equilibria and transformations, oxidation, theoretical phase diagram generation and non-ideal solution theory. **(*Prerequisite: MSEG 0625)***
MSEG 0627	**FRACTURE MECHANICS**. CR. 3. Basic principles and applications of fracture mechanics by integrating aspects of materials science and solid mechanics. Emphasis is placed on linear elastic and nonlinear elastic-plastic fracture mechanics theories; practical knowledge of fracture toughness evaluation of metals, polymer and ceramic composites; fatigue crack propagation. ***Prerequisite: MENG 0416.***
MSEG 0628	**FINITE ELEMENT METHOD**. Cr. 3. Principles of finite element analysis, variation principles, displacement polynomials and shape functions, element family, application to 2D and 3D continuum problems, application to thermal and fluid flow problems, computer program development. ***Prerequisites: Graduate standing and instructor's approval.***
MSEG 0629	**MICROSTRUCTURAL ANALYSIS OF MATERIALS**. Cr. 3. To provide an integrated treatment of the science of microstructural analysis which emphasizes the interaction of the specimen with the electron beam used to probe the microstructure. The three main aspects of microstructural morphology, phase identification, crystallography, and microanalysis of the chemical composition will be covered. Following an

	and physics of operation of Si high power devices, SiC high-power and high-temperature devices, advances in GaN device structures. A comparative study of advanced semiconductor materials and their processing technologies.
MSEG 0647	**SPECIAL TOPICS IN ADVANCED SEMICONDUCTOR DEVICES**. CR. 3. Advanced bipolar devices and fabrication technology, heterojunction bipolar transistors, advanced/MOS devices the BICMOS process.
MSEG 0663	**SPECIAL FUNCTIONS.** CR. 3. Infinite series of functions, improper integrals. Gamma function, beta function, digamma and polygamma functions. Error function and related functions. Elliptic integrals. Legendre polynomials, Legendre series and theory conveyance. Hermite polynomials, Laguerre polynomials, Bessel functions of the first kind. Integrals of Bessel function. Orthogonality of Bessel functions and recurrence formulas.
MSEG 0690	**SPECIAL TOPICS**. Cr. 3. Advanced topics in materials science and engineering **(prerequisite: Graduate standing and approval of major professor and instructor).**
MSEG 0801	**CONTINUOUS REGISTRATION**. Cr. 0.
MSEG 0802	**CANDIDATE FOR DEGREE.** Cr. 0.

List of Key Graduate Faculty Members		
Mahesh Hosur, Ph.D.	334-724-4220	hosur@mytu.tuskegee.edu
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Additional details that are not shown in this handout may be found in the Bulletin of the Department of Materials Science and Engineering, the TU's Graduate Handbook and website.