

CERAMIC ENGINEERING

The ceramic engineering program in the department of materials science and engineering offers comprehensive graduate education in a number of areas including structural ceramics, electronic materials, high temperature materials, and glass. Further information on these opportunities and facilities available to carry out research in ceramic engineering may be found under materials science and engineering.

Degree Requirements

M.S. and Ph.D. degrees are offered in ceramic engineering. The total number of hours required for the M.S. in ceramic engineering is 30. A minimum of 6 hours of 6000-level lectures and a minimum of 11 hours of graduate research on the Missouri S&T campus are required. A maximum of 6 hours of 4000-level lecture credit may be accepted.

The minimum number of hours (beyond the bachelor's degree) required for the Ph.D. in ceramic engineering is 72. At least 12 hours of course work outside of ceramic engineering is recommended, a minimum of 24 hours will be dissertation research, and a minimum of 24 hours must be course work. Students will also be required to take and pass qualifying and comprehensive exams in accordance with Missouri S&T rules.

Richard K Brow, Curators Distinguished Professor
PHD Pennsylvania State University
Curators' Professor of Ceramic Engineering, and Senior Investigator,
Graduate Center for Materials Research.

Anthony Convertine, Roberta and G. Robert Couch Assistant Professor
PHD University of Southern Mississippi

Fatih Dogan, Professor
PHD Technical University of Berlin

Arezoo Emdadi, Assistant Professor
PHD Missouri University of Science and Technology

William G Fahrenholtz, Curators Distinguished Professor
PHD University of New Mexico
Director, Graduate Center for Materials Research.

Gregory E Hilmas, Curators Distinguished Professor and Department
Chair
PHD University of Michigan-Ann Arbor

Wayne Huebner, Professor
PHD University of Missouri-Rolla

Aditya Kumar, Associate Professor
PHD Ecole Polytechnique Federale de Lausanne (EPFL)

David Lipke, Assistant Professor
PHD Georgia Institute of Technology

Jeffrey D Smith, Professor
PHD University of Missouri-Rolla

Jeremy Lee Watts, Associate Research Professor
PHD Missouri S&T

Kelley Wilkerson, Assistant Teaching Professor
PHD Missouri University of Science and Technology

CER ENG 5000 Special Problems (IND 0.0-6.0)
Problems or readings on specific subjects or projects in the department.
Consent of instructor required.

CER ENG 5001 Special Topics (LEC 0.0-6.0)
This course is designed to give the department an opportunity to test a new course. Variable title.

CER ENG 5002 Cooperative Training (IND 1.0-3.0)
On-the-job experience gained through cooperative education with industry, with credit arranged through departmental cooperative advisor. Grade received depends on quality of reports submitted at work supervisor's evaluation.

CER ENG 5040 Oral Examination (IND 0.0)
After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

CER ENG 5099 Research (IND 0.0-15)
Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

CER ENG 5115 X-Ray Diffraction Analysis (LAB 1.0 and LEC 2.0)
Theory and practical aspects of x-ray diffraction analysis are covered including diffraction theory, qualitative and quantitative analysis techniques, electronic databases, and operation of modern powder diffractometers. Students cannot receive credit for both Cer Eng 3417 and Cer Eng 5115. Prerequisite: Preceded or accompanied by Cer Eng 3410.

CER ENG 5220 Advanced Mechanical Properties of Ceramics (LAB 1.0 and LEC 3.0)
An advanced course to treat the theory and testing practice related to design based on the mechanical properties of ceramics. The course also includes a laboratory consisting of experiments for the characterization of the mechanical properties of ceramics. Prerequisites: Graduate standing.

CER ENG 5230 Glass Science And Engineering (LEC 3.0)
The development, manufacturing methods, applications, and properties of flat, fiber, container, chemical, and special purpose glasses. Composition/property relationships for glasses and nucleation-crystallization processes for glass-ceramics are also covered. Prerequisite: Consent of Instructor required.

CER ENG 5250 Refractories (LEC 3.0)
The manufacture, properties, uses, performance, and testing of basic, neutral and acid refractories. Prerequisite: Cer Eng 3230.

CER ENG 5260 Dielectric And Electrical Properties Of Oxides (LEC 3.0)

The processes occurring in inorganic materials under the influence of an electric field are considered from basic principles. Emphasis is placed on application to real systems. Prerequisite: "C" or better grade in Cer Eng 4210.

CER ENG 5310 Advanced Ceramic Processing (LEC 3.0)

Materials, processing and design of microelectronic ceramics are covered. Introduction to devices, triaxial ceramics, high aluminas, tape fabrication, metallizations, thick film processing and glass-to-metal seals. Prerequisites: Cer Eng 3210 and Cer Eng 3325.

CER ENG 5810 Principles Of Engineering Materials (LEC 3.0)

Examination of engineering materials with emphasis on selection and application of materials in industry. Particular attention is given to properties and applications of materials in extreme temperature and chemical environments. A discipline specific design project is required. (Not a technical elective for undergraduate metallurgy or ceramic majors) (Co-listed with Aero Eng 3877, Chem Eng 5300, Physics 4523, Met Eng 5810).

CER ENG 6000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

CER ENG 6001 Special Topics (IND 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

CER ENG 6050 Continuous Registration (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

CER ENG 6085 Internship (IND 0.0-15)

Students working toward a doctor of engineering degree will select with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

CER ENG 6099 Research (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

CER ENG 6220 Optical Properties Of Materials (LEC 3.0)

The objective of this course is to give the student a fundamental understanding of the structure-optical property relationships exhibited by isotropic and anisotropic materials. Topics will include the wave/particle nature of light, how light interacts with materials, color, and applications such as lasers, fiber optic communication systems, electro-optics, and integrated optics. Prerequisites: Physics 2135 or 2111 and Math 2222.

CER ENG 6230 Composite Materials (LEC 3.0)

The objective of this course is to provide students an advanced understanding of process-structure-property relationships in composites. Topics will include composite architecture, constituents, interfaces, fabrication techniques, analytical and numerical micromechanics and macromechanics, design criteria, and contemporary issues in composite materials. Prerequisite: Graduate Standing.

CER ENG 6240 Advanced Topics On The Vitreous State (LEC 3.0)

Modern aspects of the structure and dynamics of inorganic vitreous materials will be reviewed and applied towards understanding the macroscopic properties of glasses. Prerequisite: Graduate standing.

CER ENG 6260 Advanced Electrical Properties of Ceramics (LAB 1.0 and LEC 3.0)

The application of ceramic chemistry and physics to the development and evaluation of electronic, dielectric, magnetic, and optical properties. Emphasis is placed on the relationships between properties and crystal structure, defects, grain boundary nature, and microstructure. Prerequisite: Grade of "C" or better in Physics 2305.

CER ENG 6310 Sintering And Microstructure Development (LEC 3.0)

Theory and practice of densification, microstructure evolution, effect of processing and material factors, grain boundary migration, grain growth. Prerequisite: Graduate standing.

CER ENG 6410 Advanced Integrated Computational Materials Engineering (LAB 1.0 and LEC 2.0)

Students will learn of different computational tools for studying materials at different length scales. The bridging between different modeling scales will be discussed. This course has a computational laboratory to build models and run simulations. Students will complete a final project by integrating two length-scale models. Prerequisite: A grade of "B" or better grade in Math 3304.
