

MATERIALS SCIENCE - PH.D.

College of Arts and Sciences
www.kent.edu/materials-science

About This Program

The Materials Science Ph.D. program offers advanced coursework and research opportunities in materials science, preparing you for a career in academia or industry. With experienced faculty and access to state-of-the-art facilities, you will be equipped with the skills needed to make an impact in the field. Read more...

Contact Information

- **Antal Jakli** | MSGPdirector@kent.edu | 330-672-3899
- Connect with an Admissions Counselor: U.S. Student | International Student

Program Delivery

- **Delivery:**
 - In person
- **Location:**
 - Kent Campus

Examples of Possible Careers and Salaries*

Computer and information research scientists

- 15.4% much faster than the average
- 32,700 number of jobs
- \$126,830 potential earnings

Physical scientists, all other

- -3.0% decline
- 22,800 number of jobs
- \$107,210 potential earnings

Physicists

- 7.3% faster than the average
- 18,200 number of jobs
- \$129,850 potential earnings

Biochemists and biophysicists

- 4.0% about as fast as the average
- 34,600 number of jobs
- \$94,270 potential earnings

Biological scientists, all other

- 2.2% slower than the average
- 44,700 number of jobs
- \$85,290 potential earnings

Chemists

- 4.7% about as fast as the average
- 86,700 number of jobs
- \$79,300 potential earnings

Chemical engineers

- 4.4% about as fast as the average
- 32,600 number of jobs
- \$108,540 potential earnings

* Source of occupation titles and labor data comes from the U.S. Bureau of Labor Statistics' Occupational Outlook Handbook. Data comprises projected percent change in employment over the next 10 years; nation-wide employment numbers; and the yearly median wage at which half of the workers in the occupation earned more than that amount and half earned less.

For more information about graduate admissions, visit the graduate admission website. For more information on international admissions, visit the international admission website.

Admission Requirements

- Bachelor's degree or higher from an accredited college or university
- Minimum 2.750 GPA on a 4.000-point scale
- Official transcript(s)
- Goal statement
- Résumé or curriculum vitae
- Two letters of recommendation
- English language proficiency - all international students must provide proof of English language proficiency (unless they meet specific exceptions to waive) by earning one of the following:¹
 - Minimum 71 TOEFL iBT score
 - Minimum 6.0 IELTS score
 - Minimum 50 PTE score
 - Minimum 100 DET score

GRE scores (general and subject test in physics or chemistry) are not required, but strongly recommended. Admission will be granted by examination of the student's background on an individual basis. Students from a variety of undergraduate majors—such as physics, chemistry, engineering and materials science—are invited to apply.

¹ International applicants who do not meet the above test scores may be considered for conditional admission.

Application Deadlines

- **Fall Semester**
 - Priority deadline: January 15
Applications submitted by this deadline will receive the strongest consideration for admission.

Program Requirements

Major Requirements

| Code | Title | Credit Hours |
|---------------------------|---------------------------------|--------------|
| Major Requirements | | |
| MTSC 72242 | CHARACTERIZATION OF SOFT MATTER | 3 |

| | | |
|---|---|-----------|
| MTSC 73000 | PHYSICS OF SOFT MATTER | 3 |
| MTSC 73015 | CHEMISTRY OF SOFT MATTER | 3 |
| MTSC 73020 | APPLICATIONS OF SOFT MATTER | 3 |
| Approved Electives, choose from the following: | | 18-48 |
| BSCI 70158 | MOLECULAR BIOLOGY | |
| BSCI 70220 | BIOINFORMATICS | |
| BSCI 71120 | BIOLOGICAL LIGHT MICROSCOPY | |
| CHEM 70254 | BIOMEMBRANES | |
| CHEM 70352 | INORGANIC MATERIALS CHEMISTRY | |
| CHEM 70451 | ORGANIC MATERIALS CHEMISTRY | |
| CHEM 70559 | NANOMATERIALS | |
| CHEM 70571 | SURFACE CHEMISTRY | |
| MTSC 72241 | STATISTICAL MECHANICS OF SOFT MATTER | |
| MTSC 72249 | LABVIEW FOR DATA ACQUISITION AND INSTRUMENT CONTROL | |
| MTSC 72335 | ADVANCED LIQUID CRYSTALLINE AND POLYMERIC MATERIALS | |
| MTSC 72450 | LIQUID CRYSTAL OPTICS I: THEORY | |
| MTSC 72452 | LIQUID CRYSTAL OPTICS II: OPTICAL SYSTEMS | |
| MTSC 72460 | LIQUID CRYSTAL MATERIALS SCIENCE | |
| MTSC 72462 | LIQUID CRYSTAL SCIENCE: PHYSICAL PROPERTIES | |
| MTSC 72640 | LIQUID CRYSTAL, POLYMER AND COLLOID COMPOSITES | |
| MTSC 72643 | ELECTRO-OPTICS OF LIQUID CRYSTALS: MODELING AND DEVICE DESIGN | |
| MTSC 72647 | STRUCTURED FLUIDS | |
| MTSC 72650 | COMPUTATIONAL MATERIALS SCIENCE | |
| MTSC 72651 | NANOBIOTECHNOLOGY | |
| MTSC 73010 | LYOTROPIC LIQUID CRYSTALS | |
| MTSC 73025 | ACTIVE MATTER | |
| MTSC 73100 | EMERGING DISPLAY TECHNOLOGIES | |
| MTSC 74491 | SEMINAR: LIQUID CRYSTALS | |
| MTSC 74495 | SPECIAL TOPICS IN CHEMICAL PHYSICS | |
| MTSC 75006 | LIQUID CRYSTAL DEVICE PROTOTYPING | |
| MTSC 75008 | LIQUID CRYSTAL DEVICE CONSTRUCTION | |
| MTSC 75032 | SCIENTIFIC COMMUNICATION | |
| MTSC 80498 | RESEARCH | |
| PHY 76403 | ADVANCED CONDENSED MATTER PHYSICS | |
| PHY 78401 | LIQUID CRYSTAL PHYSICS | |
| Additional courses with advisor approval | | |
| <i>Culminating Requirement</i> | | |
| MTSC 80199 | DISSERTATION I ¹ | 30 |
| Minimum Total Credit Hours for Post-Baccalaureate Students | | 90 |
| Minimum Total Credit Hours for Post-Master's Students | | 60 |

¹ Each doctoral candidate, upon admission to candidacy, must register for MTSC 80199 for a total of 30 credit hours. It is expected that a doctoral candidate will continuously register for Dissertation I, and thereafter MTSC 80299, each semester, until all requirements for the degree have been met. A prospectus of the dissertation research project is required for all Ph.D. candidates. The prospectus is prepared jointly with the student's dissertation advisor. The prospectus must be approved by the members of the student's dissertation committee. A dissertation presenting and interpreting results of original research is required for the Ph.D. degree. Following acceptance of the dissertation by the dissertation committee, the final degree requirement is the satisfactory completion of the final oral exam (defense of dissertation) in front of a committee of graduate materials science faculty and

representatives from other departments in the College of Arts and Sciences.

Graduation Requirements

| Minimum Major GPA | Minimum Overall GPA |
|-------------------|---------------------|
| - | 3.000 |

Candidacy Requirement

In addition to satisfying the course work, students must pass the materials science candidacy examination. The examination is divided into two parts, a written exam and an oral exam.

The written exam is scheduled first, followed by the oral exam. The exams will cover the core courses of the materials science program taken during the first year. Students who do not pass the candidacy exam the first time may take it a second time. The first attempt at candidacy usually will take place in August, during the week before the start of the fall semester of the student's second year of study. The second attempt usually will take place in January, during the week before the start of the spring semester of the student's second year of study. A request for exception will be considered for medical reasons or for other unpredictable circumstances. Requests must be submitted in writing with supporting documentation prior to the test date and must be approved by the candidacy exam committee and by the director of the materials science program.

Students who fail the second attempt cannot continue towards the doctoral degree, but may complete the requirements for the Master of Science degree.

Program Learning Outcomes

Graduates of this program will be able to:

1. Develop an advanced understanding of the fundamental science of liquid crystals and related advanced materials and ability to apply acquired knowledge of physical and chemical properties of soft materials and devices such as liquid crystals, polymers, colloids and active matter.
2. Gain experience in presenting scientific data in research publications, articles, posters and oral presentations.
3. Apply acquired knowledge to the discovery of new advanced materials and development of advanced materials-based devices and applications.

Full Description

The Ph.D. degree in Materials Science provides students with extensive scientific training, cutting-edge research opportunities and engineering skills necessary for a variety of careers in academy and industry. Program faculty and students conduct research through Kent State's participating departments and the Advanced Materials and Liquid Crystal Institute. Such research includes liquid crystal synthesis and molecular design; properties of liquid crystals and related advanced materials; lyotropic liquid crystals and bio-related materials, opto-electronics; and nanoscience and nanotechnologies. These important research foci are inherently interdisciplinary.