Materials and Nanotechnology

Department Information

- **Program Director:**
  Erik K. Hobbie, Ph.D.
- **Email:**
  Erik.Hobbie@ndsu.edu
- **Department Phone:**
  (701) 231-6103
- **Department Web Site:**
  www.ndsu.edu/materials_nanotechnology/ (http://www.ndsu.edu/materials_nanotechnology/)
- **Application Deadline:**
  April 1 for fall semester.
- **Credential Offered:**
  Ph.D.
- **Test Requirement:**
  GRE
- **English Proficiency Requirements:**
  TOEFL iBT 71, IELTS 6; Duolingo 100

North Dakota State University (NDSU) offers an interdisciplinary program leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degree in Materials and Nanotechnology (MNT). The program includes a series of required MNT core courses; additional elective courses; written and oral preliminary examinations; a doctoral dissertation based on independent, original research in materials and nanotechnology; and a final oral examination on the dissertation.

Admission Requirements

The program in Materials and Nanotechnology is open to qualified graduates of universities and colleges of recognized standing. Applicants with a degree in the disciplines of chemistry, engineering, material science and engineering, physics, polymer science, polymer engineering, or related fields will be considered for admission. Applicants must meet the Graduate College requirements (https://catalog.ndsu.edu/graduate/admission-information/).

Financial Assistance

Students are routinely supported through research assistantships. Applicants are considered based on scholarship, potential to undertake advanced study and research, and financial need. All students who submit complete applications by the appropriate deadlines are considered for assistantships.

In addition to the stipend, graduate assistants receive a graduate tuition waiver. Tuition waivers cover base tuition for NDSU graduate credits only. Students are responsible for differential tuition, student fees, and tuition for non-graduate level credits taken or Cooperative Education credits.

By the end of the first academic year, the student will select an academic adviser from among the MNT faculty and arrange for the appointment of a supervisory committee. This committee will consist of at least four members of the graduate faculty. This includes the student's major adviser, at least one additional MNT faculty member, and a graduate school representative

The plan of study will be prepared by the student, in consultation with the major adviser and supervisory committee, by the end of the first year in residence. The plan must be approved by the student's graduate supervisory committee, the MNT Program Director, and the Graduate College dean. Master's students must complete the plan of study by the end of the second semester of study. Doctoral students should complete the plan of study at the end of the first year of study and at least one month prior to the comprehensive oral examination

Master of Science

Materials and Nanotechnology students are able pursue a master's degree under either the Plan A - Master's Thesis or the Plan C - Culminating Experience option. Each option requires a minimum of 30 graduate credits with a cumulative grade point average of 3.0 or better.

The Plan A thesis option represents a more traditional Master of Science degree, with an independent research component in the form of an original thesis that can serve as a foundation for future doctoral work in science or engineering. For the thesis option, of the required minimum 30 graduate credits, at least 16 credits must be from approved graduate courses numbered from 601-689, 691, 700-789, and 791 while the research credits (798) must be not fewer than 6 nor more than 10.

The Plan C option is appropriate for working professional students or students who are certain that they do not wish to pursue a doctorate in any field of science or engineering. . In the context of the MNT program, this option requires a 6-10 credit culminating experience (794) which replaces the research credits (798).

Ph.D.

The doctorate requires a minimum of 90 graduate credits. A minimum of 27 credits of didactic coursework are required; no more than 15 didactic credits may be transferred as part of the Plan of Study. The MNT Ph.D. program requires students to complete a series of 7 core courses totaling 17 semester credits. The student will complete additional elective courses to fulfill the Graduate School requirement of 27 semester credits in academic courses. An overall GPA of 3.0 or better must be maintained.

Core Curriculum

Code	Title	Credits
MNT 729	Materials Characterization	3
MNT 730	Nanotechnology and Nanomaterials	3
MNT 732	Physical Properties of Materials	3
MNT 745	Preparing Future Researchers	1
MNT 756	Molecular Modeling	3
MNT 760	Materials Synthesis Processing	3
MNT 790	Graduate Seminar	1

Students must complete at least an additional 12 credits of graduate level coursework. The courses should be chosen by the students in consultation and with the approval of the student's supervisory committee.

Suggested courses include the following:

Code	Title	Credits
Microelectronics Focus		
ABEN 682	Instrumentation & Measurements	3
CPM 796	Special Topics	2
CHEM 766	Quantum Chemistry I	4
CHEM 767	Quantum Chemistry II	2
ENGR 780	Electromagnetic Theory	3
ECE 751	Electromagnetic Theory and Applictions	3
IME 627	Packaging for Electronics	3
IME 720	Surface Engineering	3
IME 635	Plastics and Injection Molding Manufacturing	3
MNT 735	Optoelectronics Materials and Processing	3
PHYS 771	Quantum Physics I	3
Biomaterials Focus		
ABEN 758	Applied Computer Imaging and Sensing for Biosystems	3
BIOC 716	Protein and Enzyme Biochemistry	3
BIOC 673	Methods of Biochemical Research	3
CE 725	Biomaterials-Materials in Biomedical Engineering	3
CPM 771	Modern Methods of Polymer Characterization	3
ME 668	Introduction to Biomechanics	3
ME 731	Mechanical Behavior of Materials	3
ME 743	Biomechanics Of Impact	3
ECE 685	Biomedical Engineering	3
ECE 687	Cardiovascular Engineering	3
PSCI 611	Principles of Pharmacokinetics and Pharmacodynamics	3
PSCI 701	Quantative Drug Design	2
Nanomaterials Focus		
CE 641	Finite Element Analysis	3
CE 793	Individual Study/Tutorial	3
CPM 673	Polymer Synthesis	3

CHEM 766	Quantum Chemistry I	4
CHEM 767	Quantum Chemistry II	2
CPM 686	Corrosion and Materials	3
CPM 773	Organic Chemistry Of Coatings	3
CPM 782	Physical Chemistry Of Coatings	3
CPM 796	Special Topics	3
IME 720	Surface Engineering	3
ME 682	Fuel Cell Science and Engineering	3
ME 712	Advanced Finite Element Analysis	3
ME 733	Polymer Nanocomposites	3
ME 734	Smart Materials and Structures	3
PHYS 758	Statistical Physics	3
PHYS 781	Solid State Physics	3
General Materials Science and Engineering Focus		
ABEN 658	Process Engineering for Food, Biofuels and Bioproducts	3
ABEN 644	Transport Processes	3
ME 673	Polymer Engineering	3
CE 641	Finite Element Analysis	3
CE 720	Continuum Mechanics	3
CHEM 732	Advanced Survey of Analytical Chemistry	4
CHEM 736	Mass Spectrometry	2
CPM 673	Polymer Synthesis	3
ME 633	Composite Materials Science and Engineering	3
ME 751	Advanced Thermodynamics	3
PHYS 611	Optics for Scientists & Engineers	3
PHYS 781	Solid State Physics	3

Affiliated Faculty

Achintya N. Bezbaruah, Ph.D.
University of Nebraska-Lincoln, 2002
Research Interests: Environmental Sensors, Recalcitrant and Micro Pollutants, Contaminant Fate and Transport, Small Community Water and Wastewater Treatment, Environmental Management

Dr. Yongki Choi, PhD
City University of New York, 2010
Research Interests: Nanoparticle Based Electronics and Sensors

Andrew Croll, Ph.D.
McMaster University, Ontario, 2009
Research Interests: Polymers, Diblock Copolymers, Thin Films, Pattern Formation, Mechanics

Stuart G. Croll, Ph.D.
University of Leeds, 1974
Postdoctoral: National Research Council, Canada
Research Interests: Weathering Durability of Coatings, Physical Chemistry and Suspension Stability, Pigmentpolymer Interactions, Film Formation Processes, Coating and Polymer Physics

Alan R. Denton, Ph.D.
Cornell University, 1991
Postdoctoral, University of Guelph,1991-94; Technical University of Vienna, 1994-95, Research Center Julich, 1996-98
Research Interests: Soft Condensed Matter Theory, Computational Physic

Erik K. Hobbie, Ph.D.
University of Minnesota, 1990
Postdoctoral: NRC Fellow, NIST, 1990-1992
Research Interests: Colloidal nanoparticles, Polymers, Complex Fluids, Chromatography, Self-assembly, Photoluminescence, Flexible Electronics

Syeed M. Iskander, Ph.D.

Virginia Polytechnic Institute and State University, 2019
Postdoctoral, University of Southern California, 2019-2020
Research Interests: Non-recyclable Municipal Solid Waste Management, Food Waste Management, Plastics Pollution, Landfilling, and Landfill

Long Jiang, Ph.D.
Nanyang Technological University, 2003
Research Interests: Polymer and Polymer Composite Processing, Polymer Processing Machinery and Design, Nanocomposites, Polymers and Composites Derived from Biomass, Functional Composites with Novel Microstructures.

Alan R. Kallmeyer, Ph.D.
University of Iowa, 1995
Research Interests: Theoretical, Computational, and Experimental Solid Mechanics, Fatigue and Fracture of Engineering Materials, Composite Materials

Dinesh Katti, Ph.D.
University of Arizona, 1991
Research Interests: Geotechnical Engineering, Constitutive Modeling of Geologic Materials, Expansive Soils, Multiscale Modeling, Steered Molecular Dynamics, Computational Mechanics,
Nanocomposite, and Bionanocomposites

Kalpana Katti, Ph.D.
University of Washington, 1996
Research Interests: Advanced Composites, Nanomaterials, Biomaterials, Biomimetics, Materials Characterization and Modeling, Analytical Electron Microscopy, and Microspectroscopy, Bone Tissue Engineering

Dmitri Kilin, Ph.D.
Chemnitz University of Technology, 2000
Research Interests: Photo-induced Dynamic Processes of Charge Transfer, Nonradiative Charge Carrier Relaxation, Surfaces/Interfaces of Metal/Semiconductor Nanomaterials For Photovoltaic/Photocatalytic Energy Conversion

Svetlana Kilina, Ph.D.
University of Washington, Seattle, 2007
Research Interests: Photoexcitation Process on the Organic-Inorganic Interfaces in Hybrid Nanostructures: Functionalized Carbon Nanotubes and Quantum Dots; Non-adiabatic Dynamics in Hybrid Nanostructures: Electron-Phonon Interactions in Ligated Quantum Dots and Function

Andrei Kryjevski, Ph.D.
University of Washington, 2004
Research Interests: First-principles Theoretical Descriptions of the Electronic Properties of Nanomaterials

Ivan T. Lima Jr., Ph.D.
University of Maryland, 2003
Research Interests: Photonics

Sylvio May, Ph.D.
Jena, 1996
Research Interests: Physics of Lipid Membranes, Biophysics

Keerthi Nawarathna, Ph.D.
University of Houston, 2005
Research Interests:
Lab-on-a-chip Technologies, Single-cell Genomics, Nanobioengineering, Tissue Engineering, Novel Imaging Techniques for Biology, Computation/simulations

Mohiuddin Quadir, Ph.D.
Freie University of Berlin, 2010
Research Interests:
High Performance Delivery Technologies, Biosynthetic Interfaces for Medical Coatings, Synthesis of New Polymers from Bio-based Resources

Bakhtiyor Rasulev, Ph.D.
Uzbek Academy of Science, 2002
Postdoctoral, Drew University, 2002; Jackson State University, 2004-2007
Research Area: Structure-Property Studies of Materials, Cheminformatics for Materials, Modeling of Nanomaterials Interactions With Biosystems, Nano-Descriptors, Development of Predictive Structure-Activity/Toxicity Models

Mukund P. Sibi, Ph.D.

City University of New York, 1980
Postdoctoral, Dartmouth College, 1980-1982; University of Waterloo, 1982-1985
Research Interests: Synthetic Organic Chemistry, Natural Products

Wenfang Sun, Ph.D.
Chinese Academy of Sciences, 1995
Postdoctoral, University of Alabama, Birmingham, 1997-1999
Research Area: Organic Materials Chemistry

Xiangqing (Annie) Tangpong, Ph.D.
Carnegie Mellon University, 2006
Research Area: Vibrations, Dynamics and Friction: Friction-Vibration Interaction; Friction Damping in Rotating Structures; Damping in Nanocomposites and Biomaterials.

Chad A. Ulven, Ph.D.
University of Alabama at Birmingham, 2005
Research Interests: Advanced Composites Materials, Green Materials Processing, Nondestructive Evaluation, Characterization of Advanced Materials Under Extreme Conditions

Andriy Voronov, Ph.D.
Lviv Polytechnic Institute, 1994
Postdoctoral, Institute Charles Sadron, CNRS, 1997
Research Interests: Polymer Synthesis and Characterization

Alexander J. Wagner, Ph.D.
University of Oxford, 1997
Postdoctoral MIT, 1998-2000, Edinburgh, 2000-2002
Research Interests: Computational Soft Matter, Phase Separation, Diffusion, Interface Physics

Danling Wang, Ph.D.
University of Washington, 2013
Research Interests: Chemiresistive Sensors, Semiconducting Nanomaterials, Optical Spectroscopy, Electronic Devices, Microfabrication

Dean Webster, Ph.D.
Virginia Polytechnic Institute and State University 1984
Research Interests: Synthesis of High Performance Polymers, Polymerization Reactions, Crosslinking Chemistry, Quantitative Structure-Property Relationship

Xiangfa Wu, Ph.D.
University of Nebraska-Lincoln, 2003
Beijing Institute of Technology, 1998
Research Interests: Nanofabrication/Nanomaterials, Advanced Functional Composites, Fracture/Impact Mechanics

Wenjie Xia, Ph.D.
Northwestern University, 2016
Research Interests: Multiscale Modeling, Mechanics of Materials, Polymers and Composites, Soft Matter, Bioinspired Materials, Mechanobiology

Qifeng Zhang, Ph.D.
Peking University, 2001
Postdoctoral, University of Washington, 2006-2008
Research Interests: Electronic Materials, Nanomaterials: Synthesis, Characterization and Device Application, Nanotechnology, Materials/Devices/Technology for Energy Conversion and Storage, Solar Cells, Lithium Ion Batteries, Photocatalysis