

## COATINGS and POLYMERIC MATERIALS

Everybody uses products that are painted or coated in everyday life, but often take coatings for granted. However, a \$100 billion industry exists to supply paints and coatings worldwide that decorate, protect and provide function to automobiles, building, furniture, aircraft, ships, appliances, bridges, medical devices, electronic devices and countless other objects. The performance of these coatings depends critically on specially tailored polymers, which form coating films. Thus, coatings scientists must also be good polymer scientists. Other scientific disciplines are also important to the coatings scientist, such as organic chemistry, electrochemistry, rheology, surface chemistry, chemical analysis, photochemistry, mathematics, physics and several branches of engineering and materials science.

### Background Information

North Dakota State University started offering polymer and coatings chemistry courses in 1905. Of the few universities offering training that focuses on the technology of paints and coatings, NDSU has the longest and most extensive experience. Over the decades, the Department of Coatings and Polymeric Materials has established a worldwide reputation for education and research. Today, there is a high demand for coatings and polymer scientists at all degree levels, providing coatings and polymer materials graduates with abundant job opportunities. NDSU graduates are especially sought after by companies in the paint, coatings, and polymer industries. Graduates of the program are employed by major paint, coatings, polymer, and chemical companies with many graduates attaining upper management positions. At the undergraduate level, Bachelor of Science degrees in science and engineering with a coatings and polymeric materials minor are offered. Master's and doctoral degrees are available at the graduate level. A 4+1 accelerated B.S./M.S degree program is also available.

### The Faculty

Currently, the department consists of seven faculty, plus adjunct faculty, postdoctoral associates, graduate students and undergraduate researchers. The faculty includes individuals who have had extensive experience in the coatings and polymer industries, who have in-depth experience in polymer synthesis, polymer characterization, polymer rheology, corrosion, coatings design, surface chemistry, organic chemistry, material degradation and computer modeling. Faculty members are in high demand as consultants and speakers in America, Europe, and Asia.

### Advisory Board

The department has close relationships with the coatings and chemical industries as well as suppliers and customers to the industry. To maintain the relevance of the programs, the department meets regularly with an advisory board comprised of prominent industry professionals. The advisory board members review the program and provide feedback and suggestions for improvements. All students involved with the program have the opportunity to meet with advisory board members.

Organizations represented on the advisory board include Axalta, Eastman Chemical Company, PPG Industries, 3M, Sherwin-Williams, Dow Chemical, Allnex, Tecton, Covestro, AkzoNobel, BASF, Air Products, Boeing, and other major companies involved in the coatings and chemical industries.

### Research Opportunities

A wide range of research projects in areas such as materials science, polymer synthesis, corrosion, bio-based materials, and computer modeling are carried out by department faculty. These projects are funded by a wide variety of organizations including the National Science Foundation, Office of Naval Research, Air Force, Army, Department of Agriculture, United Soybean Board, and various companies. These projects provide undergraduate students with opportunities to participate in research both during the academic year as well as in the summer. The department also hosts two North Dakota Centers of Research Excellence: the Center for Surface Protection and the Center for Bio-based Materials Science and Technology. These centers stimulate industry-university cooperative research projects.

### Career Opportunities

Demand for graduates with expertise in coatings and polymer science exceeds the supply, and NDSU graduates are especially sought after by the coatings and chemical industries. Alumni are now employed in professional and managerial positions at most of the major coatings producers and at many other companies that produce or use coatings and polymers. The coatings industry and its suppliers need new materials to respond to pressures for improved performance, lower cost, and reduced environmental impact. Producers of electronics, computers, electrical components, communication and aerospace equipment and packaging materials all have a need for scientists trained in coatings and polymer science.

### The Program

Undergraduates in science and engineering are candidates for the Bachelor of Science degree with a minor in coatings and polymeric materials. The chemistry program is accredited by the American Chemical Society. The curriculum includes courses concentrated in the areas related to the synthesis, formulation and use of polymers and coatings, and provides excellent preparation for professional employment. These courses include lectures on the theoretical and applied aspects of the subject along with laboratories stressing the practical aspects of polymer synthesis and the preparation and evaluation of coatings. Courses on other subjects such as laboratory safety are also offered. Typically students start taking courses in coatings and polymeric materials starting in their junior year.

### Related Experiences

The Career and Advising Center assists students in finding summer jobs or internships in the laboratories of industrial companies. Many students find these experiences rewarding. The department offers a Summer Undergraduate Research Experience (SURE) for chemistry, materials science, engineering majors and related fields for students from outside of NDSU who have completed their junior year. The program has a long history of success since its conception in 1978. Students are provided with a stipend of \$4,000 for a period of 10 weeks. The program provides students with an opportunity to become involved with research in coatings and polymers and become familiar with the department.

## The Scholarship Program

Scholarships of \$500 to \$2,500 per year are available to undergraduates through the Coatings and Polymeric Materials Scholarship program. High school seniors and transfer students who plan to enter NDSU and are interested in this field are encouraged to apply through the online scholarship application system.

## Minor Requirements

To earn a minor in coatings and polymeric materials, a student must complete 16 credits from the list of approved courses.

<b>Required Courses: Select 16 credits from the following:</b>	<b>Credits</b>
CHEM 240 Survey of Organic Chemistry	3
CHEM 341 Organic Chemistry I	3
CHEM 341L Organic Chemistry I Laboratory	1
CHEM 342 Organic Chemistry II	3
CHEM 342L Organic Chemistry II Laboratory	1
CPM 451 Laboratory, Chemical, Radiation, and Biological Safety	1
CPM 472 Environment and Chemical Industries	2
CPM 473 Polymer Synthesis	3
CPM 474 Applied Polymer Science	3
CPM 475 Coatings' Materials Science	3
CPM 483 Polymer Practicum	2
CPM 484 Coatings I Laboratory	2
CPM 485 Coatings II Laboratory	2
CPM 486 Corrosion and Materials	3
CPM 487 Corrosion and Materials Laboratory	1
CPM 494 Individual Study	1-5
CPM 499 Special Topics	1-5
<b>Total Credits</b>	<b>16</b>

### Minor Requirements and Notes:

- A minimum of 8 credits must be taken at NDSU.
- If CHEM 341 Organic Chemistry I/CHEM 341L Organic Chemistry I Laboratory and CHEM 342 Organic Chemistry II/CHEM 342L Organic Chemistry II Laboratory are required for Major degree, the credits cannot also count toward a minor in Coatings and Polymeric Materials. CHEM 353 Majors Organic Chemistry Laboratory I and CHEM 354 Majors Organic Chemistry Laboratory II can be substituted for CHEM 341L Organic Chemistry I Laboratory and CHEM 342L Organic Chemistry II Laboratory.
- Chemistry majors taking CPM minor are required to have CPM 473 Polymer Synthesis.
- One CPM Laboratory Course (CPM 484 Coatings I Laboratory, CPM 485 Coatings II Laboratory, CPM 483 Polymer Practicum, CPM 487 Corrosion and Materials Laboratory)

View NDSU equivalencies of transfer courses at: [www.ndsu.edu/transfer/equivalencies](http://www.ndsu.edu/transfer/equivalencies)

### For Further Information

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