

Cooperative Research Center in Coatings

The University of Southern Mississippi and Eastern Michigan University

An improved understanding of coatings leads to innovative approaches to coatings-related problems

*A National Science
Foundation
Industry/University
Cooperative
Research Center
since 2000*

Center Mission and Rationale

The Center's two-fold mission is to be a leading academic organization that develops relevant scientific knowledge for understanding and expanding the technology of polymeric coatings and paints for the benefit of its members, and to enlarge the cadre of scientists and technologists capable of working effectively with coatings.

Coatings are one of the most important sectors of the U.S economy, and there are many opportunities for substantial technological impact. This Center brings together institutions with highly complementary capabilities to work in this area. USM is one of the leading polymers and coatings programs in the country and has exceptional strengths in the structure-property analysis of coatings; synthesis, formulation, and development of environmentally compliant coatings, and film formation. The EMU faculty are equally strong in a variety of areas relevant to coatings research, including synthetic chemistry, cross-linking of polymers, surface physics, and applications and testing of coatings. One area

of special emphasis is ultra-low volatile organic content (VOC) coatings.

Research Program

The Center started operation in 2000. Its research thrust areas are defined by critical problems facing the coatings industry and coatings users:

- Reduction and, ultimately, elimination of air pollution derived from coatings
- Cost-effective improvement of product quality
- Better understanding of coating surfaces
- Improved durability of coatings.

The Center performs precompetitive research in seven areas of science and engineering that are directly relevant to these thrust areas:

- Cross-linking chemistry and cross-linked film properties
- Low-solids and solventless coatings
- Testing and analysis of coating
- Surface mechanical analysis of coatings
 - Adhesion of coatings, especially adhesion to plastics
 - Surface and interfacial analysis and spectroscopy
 - UV curable coatings.

Projects are conducted by faculty, staff, graduate students, and postdoctoral associates of the two institutions. Resources of the institutions are combined to focus multiple skills on important problems. The Center's Industrial Advisory Board, which meets twice a year, guides project selections and implementation. Each Center member company or organization has one vote on this board.

Examples of specific research projects are:

- Collaboration of polymer synthesis chemists and rheologists to devise solvent-free, water-reducible industrial coatings with good film properties



Dr. Wade Shen, Director of the Surface Science Research Center in the Coatings Research Institute, standing adjacent to the MTS Nano-Indenter XP instrumentation located in the Physics Department.



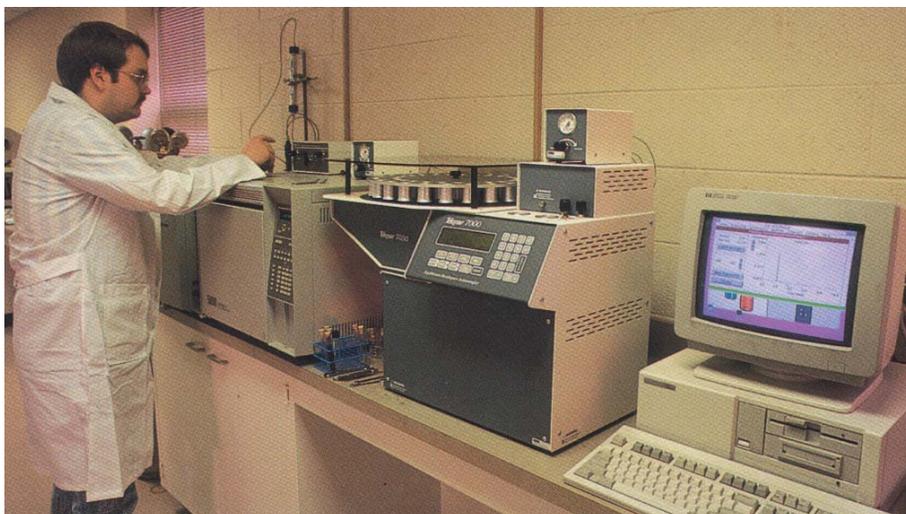
Anneke Kaminski, a graduate student at NDSU, operating a Fourier Transform stepscan Infrared Spectrometer.

- Development of more accurate methods to analyze water in paints (a critical industry problem) by chromatography and by near-infrared spectroscopy
- Use of surface/interfacial spectroscopy and imaging to study film formation of latexes and polyurethanes
- Development of environmentally complaint coatings
- Molecular-level studies of adhesion and corrosion protection by coatings
- Scanning probe microscopy studies of film formation and film properties of thermosets
- Basic studies of the physics of inorganic hard coatings on ductile plastics
- Design of artist paints for improved longevity.

Special Center Activities

The Center is an outgrowth of similar Centers that operated at EMU from 1990 to 1995 and at EMU and North Dakota State University from 1995 to 2000. Tangible accomplishments of the former Centers included:

- Over 100 publications and presentations at national meetings
- A major commercial development in a member company and numerous follow-up projects started within member companies
- Three U.S. patents
- Development of new analytical and test methods, now being adopted by industry
- Several research awards
- Education of students who, upon graduation, are highly sought by the coatings industry.



A student prepares a sample for analysis. The water content of a water-based coating will be analyzed using a Gas Chromatograph/Mass Spectrometer Head-Space Analyzer at EMU.

Capabilities and Facilities

EMU and USM are two of the largest academic programs in the United States featuring the science and technology of polymeric coatings. Together they bring unequalled resources to the study of coatings. For example, USM offers one of the few existing surface/interfacial laboratories with new FT-IR and FT-Raman instrumentation and currently focuses on combinatorial aspects of polymeric coatings. EMU has strong expertise in the synthesis and evaluation of coatings polymers, supported by up-to-date equipment, state-of-the-art scanning probe microscopy, nanoindentation, and nanoscratch equipment.

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