

# POLYMERS AND COATINGS AT CAL POLY SAN LUIS OBISPO



## A Program Unique in the West

### Curriculum

The Chemistry and Biochemistry Department at Cal Poly offers BS degrees in Chemistry and Biochemistry, with a concentration in Polymers and Coatings and a focused MS degree in Polymers and Coatings Science. Currently 300 majors are enrolled in the Chemistry and Biochemistry degree programs.

Cal Poly's Polymer and Coatings Concentration is certified by the American Chemical Society as an approved polymer program.

The Polymers and Coatings Program is unique in the West and prepares students for careers or graduate studies in the rapidly expanding field of polymers and coatings. The curriculum includes physical and organic chemistry of polymers, surface chemistry, coatings science, and extensive laboratory work. All students gain paid work experience through internships.

### Faculty

Five professors teach and direct research in the program, including the Arthur C. Edwards Endowed Chair in Coatings Technology and Ecology. Cooperation with industry insures students receive up-to-date instruction. Undergraduate and graduate research often leads to publications and presentations at national meetings. Graduates are in high demand for employment in California and elsewhere. Half of all our students continue on with graduate work at leading universities.

### Industry Support and Research

Industry supports the program through an industrial advisory council and by funding research and offering students internships. Scholarships are available for qualified students in the program. Current and recent research includes:

- ❑ Nanotechnology applications in coatings

- ❑ Analysis of volatile organic compounds by new methods
- ❑ New medical applications of polymers
- ❑ Synthesis of novel polymers
- ❑ Laboratories are available for polymer syntheses, polymer analysis, and coatings formulation and testing.
- ❑ Construction of the new Western Coatings Technology Center is scheduled to begin in 2010.

### Short Courses

Intensive short courses in polymers and coatings chemistry are offered every summer and winter on the Cal Poly campus.



## Graduate and Undergraduate Student Opportunities

**Internships:** All undergraduate students participate in an industrial internship as part of the Polymers and Coatings Program, usually during the summer. Planning for internships begins in the winter and students are placed in positions best suited to their level of experience. Incoming freshman and transfer students are also eligible for summer internships. Students in the masters program participate in an extended internship.

**Scholarships:** Industry sponsored scholarships are available for qualified Polymers and Coatings students for all years while at Cal Poly.

**Research:** Research for undergraduates is possible beginning the freshman year. Most research projects provide student stipends.

**Seminars:** The Polymers and Coatings program has an active seminar program; guest speakers from industry, government, and academic laboratories are invited to speak at Cal Poly.

**Field Trips:** Field trips provide the opportunity for students to see industrial and research applications of polymers and coatings principles. Many graduates of the Polymers and Coatings Program participate by leading tours at their companies.

### **Example Undergraduate & Graduate Level Courses**

CHEM 444 Polymers and Coatings I: Physical properties of polymers and coatings and their measurement. Molecular weight averages, glass transition, thermodynamics of polymers. Viscoelastic properties, rheology, molecular weight determination. Thermal analysis, spectroscopic analysis, mechanical testing.

CHEM 445 Polymers and Coatings II: Introduction to polymerization methods and mechanisms. Chemistry of initiators, catalysts and inhibitors. Uses of representative polymer types. Synthesis, film formation, structure and properties of polymers commonly used in coatings and adhesives.

CHEM 446 Surface Chemistry of Materials: Surface energy. Capillarity, solid and liquid interface, adsorption. Surface areas of solids. Contact angles and wetting. Friction, lubrication and adhesion. Relationship of surface to bulk properties of materials. Applications.

CHEM 447 Polymers and Coatings Laboratory I: Experimental techniques of producing and characterizing coatings. Polymer characterization and analysis. Molecular weight analysis using viscometry, light scattering, and gel permeation chromatography. Thermal analysis using differential scanning calorimetry, thermal mechanical analysis and dynamic mechanical analysis. Polymer rheology. Infrared, Raman and FT-NMR spectroscopy. Atomic force microscopy.

CHEM 448 Polymers and Coatings Laboratory II: Polymer synthesis using solution, suspension, bulk, emulsion techniques. Synthesis of chain growth polymers using free radical, anionic, cationic, and other catalysts. Synthesis of step-growth polymers. Kinetics of polymer reactions. Synthesis of resins used in modern coatings.

CHEM 449 Internship in Polymers and Coatings: Selected students will spend up to 12 weeks with an approved polymers and coatings firm engaged in production or related business. Time will be spent applying and developing production and technical skills and abilities in the polymers and coatings industry.

CHEM 544 Polymer Physical Chemistry and Analysis: Physical properties of polymers and coatings and their measurement; molecular weight averages, glass transition, thermodynamics of polymers, viscoelastic properties, rheology; molecular weight determination, thermal analysis, spectroscopic analysis, mechanical testing, atomic force microscopy. Special individual project.

CHEM 545 Polymer Synthesis and Mechanisms: Polymerization methods and mechanisms; chemistry of initiators, catalysts and inhibitors; use of representative types; synthesis, structure and properties of polymers commonly used in coatings and adhesives. Special individual project.

CHEM 550 Coatings Formulation Principles: Formulation of modern coatings. Raw materials including resins, solvents, pigments, and additives. Formulation principles for solvent-borne and high solids coatings, water-borne coatings, powder coatings, radiation cure coatings and architectural coatings. Regulatory issues; VOC's. Coating properties, film formation, film defects, application methods, color and color acceptance.

CHEM 551 Coatings Formulation Laboratory: Laboratory formulation of modern coatings. Formation of pigment dispersions. Formulation of solvent-borne and high solids coatings, water-borne coatings, powder coatings, radiation cure coatings and architectural coatings. VOC measurements. Measurement of coating properties, film formation, film defects, application methods, color and color acceptance, hiding, gloss. Accelerated weathering.

CHEM 598 Graduate Project: Supervised industrial graduate research in polymers and coatings science. Provides students with industrial research experience.

CHEM 599 Graduate Project: Directed graduate research in specialized advanced topics related to polymers and coatings science, leading to a graduate thesis of suitable quality. Requires approval of graduate advisor. Students are expected to work independently and report weekly to faculty advisor.

Detailed information on the MS program in Polymers and Coatings Science is available upon request. Students may enter the MS program upon completion of a BS degree or enter the blended BS/MS program in their junior year.

**CALIFORNIA POLYTECHNIC STATE UNIVERSITY**  
College of Science & Mathematics  
Department of Chemistry & Biochemistry  
Polymers & Coatings Program  
San Luis Obispo, CA 93407

Dr. Ray Fernando, Director  
Phone: 805.756.2395  
Fax: 805.756.5500  
e-mail: [rhfernan@calpoly.edu](mailto:rhfernan@calpoly.edu)  
[www.polymersandcoatings.calpoly.edu](http://www.polymersandcoatings.calpoly.edu)