VIRTUAL OPEN HOUSE
Graduate Admissions
TUESDAY, NOVEMBER 24, 2020
Apply to CEE!
Jan. 5th
Tonight’s Agenda

Welcome: Prof. David Cocker, Chair
Graduate Admissions: Prof. Juchen Guo
Program Overviews
  • Materials: Prof. Younjin Min
  • Biotechnology: Prof. Ian Wheeldon
  • MSOL Water Quality: Prof. Jinyong Liu
  • Air Quality Masters: Prof. Kelley Barsanti
Moderated Q&A: Faculty Panel
Close
Welcome!
Prof. David Cocker, Chair
Graduate Admissions
Prof. Juchen Guo
Department of Chemical and Environmental Engineering
Graduate Open House

Juchen Guo, Associate professor
Admissions Graduate Advisor

November 24, 2020
CHEMICAL AND ENVIRONMENTAL ENGINEERING

- ~400 undergraduate students
- ~100 graduate students
- 21 Full-Time Tenured/Tenure-track faculty
- ~$600k/per PI extramural funding
A Few Things We Are Proud Of…

- Dynamic and highly productive faculty
- Multi-disciplinary research and collaborative projects
- Well supported infrastructure and outstanding laboratory research facilities
- Large graduate program and many research opportunities for undergraduates
- Outstanding colloquium series
Graduate Program Overview

• Started in Fall 1999
• Joint Chemical and Environmental Engineering graduate program
• Offering M.Sc. and Ph.D. degrees
• M.S. in Industrial Biotechnology
• 5-year B.Sc. / M.Sc. Degree offered
Research Areas

- Advanced Materials and Nanotechnology
- Computation and Molecular Modeling
- Air Quality Systems Engineering
- Energy Conversion & Storage
- Biotechnology & Biomolecular Engineering
- Water Quality Systems Engineering

Department of Chemical and Environmental Engineering
Graduate Program Courses

Core Courses – 16 units
- CEE 200: Advanced Engineering Computation (4 units)
- CEE 202: Transport Phenomena (4 units)
- CEE 204: Advanced Kinetics and Reaction Engineering (4 units)
- CEE 206: Advanced Chemical Engineering Thermodynamics (4 units)

Plus
Ph.D. – 8 units of regular lecture graduate and/or approved upper division courses
M.S. – A minimum of 20 units of approved coursework
CEE 286: Colloquium in CEE (1 unit)
  – Taken every quarter and mandatory for all students
CEE 302: Teaching Practicum (2 units)
Ph.D. Program

Preliminary Exam
- A critical evaluation of a published scientific journal article, presented orally, followed by questions from a faculty panel.
- The article will be selected by the faculty panel comprised of faculty from CEE with appropriate expertise in the chosen area of study.
- Pass/fail based on the oral presentation and answers to questions.
- There is a second and final attempt to pass a makeup examination.
- Hold in the third quarter of study

Advancement to Candidacy Exam
- Committee member nominations due Fall quarter of 2\textsuperscript{nd} year
- Qualifying Committee (4 members from CEE, 1 outside member)
- Thesis Proposal – 15 pages, must follow format guidelines
- Oral Presentation

Dissertation and Final Oral Examination
- Dissertation Committee (3 members)
- Thesis Defense
Advisor Selection

• Process begins Fall quarter
• Advisor Selection Form will be available online
• Student indicates 3 CEE faculty choices
• Graduate Committee will review Advisor Selection Forms in December and match students with a faculty advisor
• Students will be informed of who their advisor is before Winter break
Ideal Geographical Location

- Big Bear Mountain
- Palm Springs
- Huntington Beach
- Temecula Valley
Advanced Materials and Nanotechnology

Prof. Youjin Min
What Chemical Engineers and Material Scientists Do?

- Materials science is one of the broadest and most active areas in chemical engineering.\(^1\)

- It involves the discovery, evaluation, and manipulation of useful properties in different substances. The outcome is an expanding array of materials that feature unique characteristics used for the development and fabrication of revolutionary new products.

- Achievements of Chemical Engineers in Materials Science - Development of materials with the following properties:\(^1,2\)
  - Broad resistance to chemicals
  - Unique optical properties
  - Increased antibacterial, antiviral, and antifungal capabilities
  - High-precision chemical sensing
  - Inhibition of S. aureus growth
  - Size tunable fluorescence emission
  - Nanosensors for Disease Detection

\(^1\)https://www.aiche.org/community; \(^2\)https://www.webofscience.com/
What Chemical Engineers and Material Scientists Do?

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- Achievements of Chemical Engineers in Materials Science - Development of materials with the following properties:¹,²

  - Improved flame retardance
  - Superior electrochemical energy storage

  Functional thermal and electrical insulation, Light weight with high durability, Improved tensile and impact strength, Light weight with high durability, Increased resistance to oxygen, ozone, or ultraviolet-radiation damage, etc.

¹https://www.aiche.org/community; ²https://www.webofscience.com/
Department Faculty at UC, Riverside
- Advanced Materials and Nanotechnology

Kandis Leslie Abdul-Aziz
Sustainable Catalysis and Materials

Juchen Guo
Electrochemical Materials and Interfaces

Younjin Min
Interfacial Soft-Condensed Matter

Ashok Mulchandani
Facilities at UC, Riverside

- Advanced Materials and Nanotechnology

Central Facility for Advanced Microscopy and Microanalysis
https://cfamm.ucr.edu/

The CFAMM is a universal research, service, and consulting laboratory using electron and ion beam techniques to characterize organic and inorganic materials, biological tissue, ceramics and minerals at sub-micron scale level.

Nanofabrication Facility
https://nanofab.ucr.edu/

Nanofabrication Facility Mission
UCR Nanofabrication facility
- Enables the world-class research and graduate student training in all areas of nanotechnology
- Supports research through research and cooperative agreements with scientists and engineers
- Provides a state-of-the-art research hub for students, postdoctoral researchers and professors from all disciplines
- Follows the highest international academic standards, ethics, quality and security, providing high-quality facilities
- Maintains the highest level of safety
- Serves as the framework and program for research externally funded multi-PI projects and government centers at UCR
- Facilitates cooperation with high-tech industry in the Inland Empire and California

Analytical Chemistry Instrumentation Facility
https://acif.ucr.edu/

Microscopy and Imaging Core Facility
https://microscopycore.ucr.edu/
Some Companies Recruiting in These Areas in California

- **Battery Materials Engineer**
  Apple
  Cupertino, CA
  via LinkedIn
  
  🕒 6 days ago  🗻 Full-time

- **Research Assistant**
  DuPont
  Hayward, CA
  via Careers - DuPont
  
  🕒 Over 1 month ago  🗻 Full-time

- **Chemical Engineer**
  Agilent Technologies, Inc.
  Folsom, CA
  via Folsom, CA - Geebo
  
  🕒 5 days ago  🗻 Full-time

- **Materials Engineer**
  Exponent
  Los Angeles, CA
  via ZipRecruiter
  
  🕒 Over 1 month ago  🗻 Full-time

- **Materials Engineer**
  SpaceX
  Hawthorne, CA
  via Talent.com
  
  🕒 10 days ago  🗻 Full-time

- **Senior Materials Engineer in Richmond, CA**
  Chevron
  Richmond, CA
  via Richmond, CA - Geebo
  
  🕒 5 days ago  🗻 Full-time

- **Chemistry, Chemical Engineering, Materials Science Intern**
  HP
  San Diego, CA
  via Glassdoor
  
  🕒 20 hours ago  🗻 Internship

- **Corrosion & Finishes Material & Process Engineer**
  Lockheed Martin
  Palmdale, CA
  via Clearance Jobs
  
  🕒 18 hours ago  🗻 Full-time

- **Polymer Technician**
  PPG
  California Hot Springs, CA
  via Lensa
  
  🕒 12 days ago  🗻 Full-time
Biotechnology Master’s
Prof. Ian Wheeldon
PROFESSIONAL SCIENCE MASTER’S IN INDUSTRIAL BIOTECHNOLOGY

NEXT-GEN BIOTECH EDUCATION

• M.S. in as few as 9-12 months
• One of only a few programs training biotech & bio-pharmaceutical skills
• Four focus areas
• Distinguished faculty interaction
• Biotech career prep in research, development, and production

INNOVATIVE DUAL EDUCATIONAL APPROACH

• Class and lab instruction
• Industrial internships
• Undergraduate mentoring
• Built-in CIB research training
## INDUSTRIAL BIOTECHNOLOGY

<table>
<thead>
<tr>
<th>HEALTH</th>
<th>FOOD &amp; AGRICULTURE</th>
<th>BIOFUELS</th>
<th>INDUSTRIAL</th>
</tr>
</thead>
</table>
| • Reduces rates of infectious disease  
  • Minimizes health risks and side effects through tailored treatments | • Generates higher crop yields with fewer inputs  
  • Improves food and crop oil content for cardiovascular health | • Cuts greenhouse gas emissions by 52% or more  
  • Reduces fossil fuel dependence | • Lowers the temperature for cleaning clothes, potentially saving $4.1B annually  
  • Produces biodegradable plastic alternatives |
INDUSTRIAL BIOTECHNOLOGY IS A LARGE AND GROWING SECTOR OF THE US ECONOMY

Biotechnology Revenues (>$370 Billion)

- GM Crops: $140 B
- Biologics: $110 B
- Industrial: $118 B

Industrial Biotech Revenues

- Biofuels: 9.7
- Food & Ag: 12
- Biologics feedstocks: 16
- Biochemicals: 66

REVENUES (BILLIONS)
The State of California employs 1.4 million people in total jobs attributable to the Life Science Industry (direct/indirect/induced).

$4.59 billion in research funding from National Institutes of Health (NIH) for FY2019.

15,341 Life Science establishments.

https://www.biocom.org/eir/
1 YEAR MS CURRICULUM IN INDUSTRIAL BIOENGINEERING

**Fall Quarter**
- CHE 124 Biochemical Engineering Principles
- CHE 124L Biochemical Engineering Lab
- CEE 236 Energy: Production, Uses, Economics, and Sustainability
- CEE 238A Bioprocess Design Laboratory I
- CEE 286 CEE Seminar

**Winter Quarter**
- CEE 212 Bioseparations
- CEE 211 Upstream Processes in Biotechnology
- CEE 238B Bioprocess Design Laboratory II
- CEE 286 CEE Seminar

**Spring Quarter**
- CEE 210 Cell Engineering
- CEE 248 Quantitative Analysis of Upstream
- CEE 238C Bioprocess Design Laboratory III
- CEE 286 CEE Seminar

**Summer Quarter**
- CEE 298i Industrial Internship (6-8 weeks)

**Legend**
- Process design and analysis
- Core lecture material
- Wet lab course
MSOL: Water Quality Systems Engineering
Prof. Jinyong Liu
Environmental Engineering Systems (Water)

• Explore the science and engineering principles that are essential to providing clean water and improving the natural environment.

• This specialization incorporates elements of water treatment and chemistry, covering topics such as water systems fundamentals, physical and chemical processes, biological treatment, and advanced technologies.
# Environmental Engineering Systems (Water)

<table>
<thead>
<tr>
<th>Course Prefix</th>
<th>Course Name</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>ENGR 200</td>
<td>Engineering in the Global Environment</td>
<td>4</td>
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<tr>
<td>ENGR 201</td>
<td>Technology Innovation and Strategy for Engineers</td>
<td>4</td>
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<tr>
<td>ENGR 202</td>
<td>Introduction to Systems Engineering</td>
<td>4</td>
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<tr>
<td>ENGR 203</td>
<td>Principles of Engineering Management</td>
<td>4</td>
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<tr>
<td>CEE 241</td>
<td>Water Chemistry in Natural and Engineered Systems</td>
<td>4</td>
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<tr>
<td>CEE 225</td>
<td>Physical and Chemical Separation Processes</td>
<td>4</td>
</tr>
<tr>
<td>CEE 226</td>
<td>Biological Treatment Processes</td>
<td>4</td>
</tr>
<tr>
<td>CEE 243</td>
<td>Advanced Treatment Technologies</td>
<td>4</td>
</tr>
<tr>
<td>ENGR 296 A, B, C, D</td>
<td>Project Design Course A, B, C, D</td>
<td>4 – 1 credit courses</td>
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Environmental Engineering Systems (Water)

**CEE 241 Water Chemistry**
Chemical principles and advanced calculation for acid-base equilibrium, metal-ligand coordination, solid precipitation-dissolution, redox chemistry, reaction kinetics

**CEE 225 Physical and Chemical Processes**
Water Treatment: Coagulation-flocculation-sedimentation-filtration; Disinfection; Water softening; Membrane filtration

**CEE 226 Biological Processes**
Wastewater Treatment: Microbial principles, BOD removal, Nutrient removal, Sludge treatment, Energy and resource recovery

**CEE 243 Advanced Water Treatment Technologies**
Materials and modeling for adsorption, ion-exchange, and membrane technologies; Advanced oxidation and reduction methods; Treatment train systems; Case studies and project design on PFAS treatment, nutrient control, catalyst development, and critical thinking on frontier research and development.
Faculty Members

Prof. Haizhou Liu
Water Treatment and Reuse; Advanced Oxidation; Disinfection Byproduct Control; Heavy Metals in Water Distribution Systems

Prof. Jinyong Liu
Groundwater Remediation; Advanced Reduction; PFAS Treatment; Catalytic Reduction of Perchlorate

Prof. Yujie Men
Fate, Transport, and Bioremediation of Emerging Organic Contaminants

Prof. Yun Shen
Pathogen Transmission and Control in Built Environment, Water, and Food
Master’s in Air Quality Systems Engineering
Prof. Kelley Barsanti
Some of our courses on air quality

<table>
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<tr>
<th>Department Courses</th>
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<tr>
<td><strong>CEE 136</strong></td>
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<tr>
<td><strong>CEE 207</strong></td>
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<td><strong>CEE 233</strong></td>
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<td><strong>ENVE 134</strong></td>
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<tr>
<td><strong>ENVE 138</strong></td>
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<tr>
<th>Courses Outside of the Department</th>
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<tbody>
<tr>
<td><strong>ENSC 245</strong></td>
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<tr>
<td><strong>ME 136</strong></td>
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<tr>
<td><strong>PBPL 233</strong></td>
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California air quality in the news

Los Angeles Times

Los Angeles suffers worst smog in almost 30 years

By TONY BARBOZA | STAFF WRITER
SEP. 10, 2020 | 11:45 AM UPDATED 5:09 PM
Air quality research we do in our labs

David Cocker’s group uses large Teflon chambers to study pollutant formation from sources like cars and in the complex mixture of species found in the atmosphere.
Don Collins’ group uses drones to measure ozone and other pollutants.

Kelley Barsanti’s group collects wildfire smoke samples from aircraft.

Sunni Ivey’s group uses lightweight samplers to study personal exposure.
Air quality research we do with our computers

Sunni Ivey’s group uses regional air quality models to simulate ozone formation and concentrations

Kelley Barsanti’s group uses laboratory data to improve simulation of atmospheric chemistry
Many, many others at UCR doing air quality research

**Fundamental Interactions**
- J. Zhang (Chemistry)
- Davies (Chemistry)
- Bahreini (Env. Sci.)
- H. Zhang (Chemistry)
- Cocker (Chem. Env.)
- Collins (Chem. Env.)
- Barsanti (Chem. Env.)

**Ensemble Dynamics**
- Lin (Env. Sci.)
- Hopkins (Env. Sci.)
- Jung (Mech. Eng.)
- Porter (Env. Sci.)

**Environmental Interactions**
- Ivey (Chem. Env.)
- Li (Env. Sci.)
- Allen (Earth Sci.)

**Increasing length scale and complexity**
- Molecular scale
  - Molecular and photon interactions
  - Chemical kinetics
  - Spectroscopy
- Nanoscale to microscale
  - Aerosol chemistry and trace gas interactions
  - Particle formation
  - Aerosol composition
- Local scale
  - Exposure
  - Health
  - Cloud interactions
  - Solar interaction
- Urban scale
  - Emissions
  - Exposure
  - Health
- Regional scale
  - Biomass Burning
  - Source Apportionment
  - AQ-Meteorology
- Global scale
  - Transport
  - Climate and AQ
  - Remote Sensing

Diagram: J.F. Davies and C. Ivey
An exciting addition to our (almost) campus

Southern California Headquarters

CARB is building a new Southern California Headquarters

Under construction on a 19-acre site near the campus of UCI Riverside, the approximately 380,000 square-foot facility will be one of the largest and most advanced vehicle emissions testing and research facilities in the world. It will also be the largest ‘net-zero energy’ structure (producing as much energy as it uses) of its type in the nation. The facility will also be designed to achieve Leadership in Energy and Environmental Design (LEED) Platinum certification and meet CalGreen Tier 2 standards. The facility is scheduled to be completed in early 2021.

“This striking design will make CARB’s new Southern California headquarters an immediately recognizable landmark,” said CARB Chair Mary D. Nichols. “It incorporates the highest standards of sustainability in the office and public spaces, and meets the exacting laboratory specifications we need to keep California at the forefront of our world-leading efforts to clean up our air and fight climate change.”
Faculty Q & A Panel

Please submit your questions in the chat!

All specific admissions inquiries may be sent to Mr. Desmond Harvey gradcee@engr.ucr.edu.
Connect With Us!

Chemical and Environmental Engineering

gradcee@engr.ucr.edu
@CEEatUCR
www.cee.ucr.edu

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