

Connecting Research and Society: *The Adsorption and Ion-Exchange Laboratory*

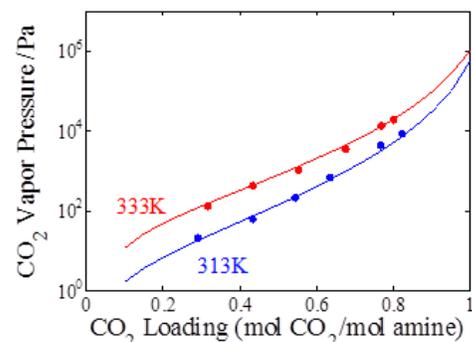
Stephen W. Thiel, PE

Dr. Stephen W. Thiel manages the Adsorption and Ion-Exchange Laboratory, a group who seeks to understand the fundamentals of adsorptions and to develop applications in Energy and Environmental Engineering and Biomolecular Engineering. Looking particularly at the thermodynamics, chemistry, and kinetics of adsorption and absorption, they strive to connect their research with real societal applications, including drug development, pollution control for power plants, and global warming.

Current Projects

The group's goal of pursuing a fundamental understanding of adsorption has allowed Dr. Thiel and his team to branch into the exciting area of engineered adsorbents and ion exchangers. Current and recent projects have focused on the following areas:

- **Drug Development:** Developing bio-mimetic adsorbents and membranes for integrating reactions and purification in drug development. Other new adsorbents, with biocatalytic membranes, are being used to combat global warming (below).
- **Pollution Control:** Exploring the use of ionic liquids and halatopolymers to develop adsorbents with unique capabilities for capturing pollutants such as mercury and arsenic.
- **Global Warming:** Understanding the fundamental thermodynamics of carbon dioxide capture by both absorption and adsorption to help address the growing problem of global warming. Using cutting-edge thermodynamic models, the group has developed new computational algorithms to dramatically reduce the computational time needed to correlate experimental data.



CO₂ Capture: Thiel and his group developed an innovative strategy to measure how much CO₂ is absorbed in various amine solvents, developed faster methods to correlate experimental data with the thermodynamic model, and measured heat of absorption, which is crucial to determining the cost of CO₂ capture.



The Adsorption and Ion-Exchange Laboratory

Dr. Neville Pinto established the Adsorption and Ion-Exchange Laboratory in 1985 and since then, the lab has been continuously funded by federal and state agencies and industry, through grants from the National Science Foundation, the Department of Energy, the Ohio Department of Development, and the Ohio Board of Regents. Garnering over \$6 million in external funding, the Adsorption and Ion Exchange Laboratory is instrumental in conducting cutting-edge research in adsorption and absorption processes. Dr. Stephen Thiel now leads the laboratory.

Left: Slipstream test unit at the Duke Facility. Thiel and colleagues developed innovative adsorbents to capture mercury and arsenic from coal combustion flue gas.

Students Working in the Lab

The mission of the Adsorption and Ion-Exchange Laboratory is to provide an advanced research environment for the education of graduate and undergraduate students in chemical engineering. The laboratory has served over 40 doctoral and master's students and numerous baccalaureate students. Many of the graduates from this laboratory now hold senior positions in industry and academia.

This student-centered environment provides the following benefits:

- Challenging projects advance research skills in areas of high demand.
- Graduate student thesis and dissertation work strengthens students' theoretical, experimental, analytical, and modeling skills.
- Students are mentored as they write papers for journals and present their work at national meetings.
- Weekly group meetings strengthen the intellectual environment.
- Students receive a rich cultural experience, interacting with students from around the world, including China, Germany, India, Iran, Jordan, Korea, Mexico, Palestine, Portugal, and Taiwan.



More about Dr. Stephen W. Thiel

Dr. Stephen Thiel manages the Adsorption and Ion Exchange Laboratory. His current research focuses on surface and interfacial phenomena, a logical extension of his previous research in membrane science, thermodynamics, and in driving fundamental laboratory results to commercial practice. He actively supports the Chemical Engineering program's efforts in biochemical, biomolecular, energy, and environmental engineering.

Dr. Thiel was born in Florida, raised in Southern California and the Washington, D.C. area, received his B.S. in Chemical Engineering from Virginia Polytechnic Institute and State University, and his M.S. and Ph.D. in Chemical Engineering from The University of Texas at Austin. In addition to his teaching and research at UC, he has worked as a cooperative education student (Oak Ridge National Laboratory), a process engineer, a strategic planning analyst, and a process development manager (Cognis Corporation). He has also served as a consultant for environmental and process development projects.

Dr. Thiel's principal activities outside of UC are related to music and education. He plays trumpet in several local ensembles, sings, and directs a handbell choir. He is also a member of National Center for Science Education (NCSE), a participant in NCSE's Project Steve, and a scientific consultant to the Clergy Letter Project.