



SOUTHWEST CATALYSIS SOCIETY

2021 AWARD SYMPOSIUM & POSTER COMPETITION

Friday, April 23, 2021, 2:30 – 5:30 pm (CT)

Virtual Meeting on Zoom and Gather.town



Corporate Sponsors





2021 Award Symposium and Poster Competition

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The SWCS Officers and I welcome you to the 2021 Southwest Catalysis Society Award Symposium and Poster Competition on Friday, April 23, 2021. The event will be held virtually on Zoom for the award lecture and Gather.town for the interactive poster competition.

The award lecture will be given on Zoom by Dr. Steve King, a retired Senior Fellow of Dow Inc. He received the 2020 Southwest Catalysis Society Award for Excellence in Applied Catalysis to recognize his significant contribution to amine catalysis and process technology.

The poster presentation and competition for Best Poster Awards is hosted interactively on Gather.town. Gather.town allows participants to walk around a virtual poster hall and lobby, and to interact with other participants nearby or within private spaces. Poster presentations are not pre-recorded; instead presenters can discuss their results with interested attendees in small groups or one-on-one.

The registration fee for the 2021 Award Symposium and Poster Competition is \$5 for regular SWCS members and free to student/postdoc/retiree members. The fee for non-members is \$10. To become a member and to register for the virtual event, please follow the instructions at <https://www.swcatsoc.org/events>. Membership costs are \$20 (regular) and \$5 (student/postdoc/retiree) and includes membership to the North American Catalysis Society (NACS).

Event details and links to Zoom and Gather.town are available on the event info page on Eventbrite after registration.

Finally, we thank all our sponsors for their kind support! Fundraising events in 2021 have been limited as in-person events were cancelled in 2020-2021 due to the pandemic. However, the generosity of our sponsors has continued to enable this year's



2021 Newly Elected Officers

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events. We particularly want to thank Celanese for reaching out this year to sponsor our virtual events by covering the cost of the platform we are using to host them. Additionally, we want to thank our 2020 sponsors as part of their donations are being dedicated to cover the monetary awards for our 2021 Poster Competition. The remaining donations from our 2020 sponsors will be rolled over to 2022.

We hope you enjoy the Virtual Award Symposium and Poster Competition!

Best wishes on behalf of the 2020-2021 Leadership Team,

Lars C. Grabow, PhD
William A. Brookshire Department of Chemical and Biomolecular
Engineering
University of Houston
Chair (2019-2021)

2021 PROGRAM

- | | |
|----------------|---|
| Noon | Gather.town space opens. Presenters can check their posters and confirm that everything was uploaded correctly. (https://gather.town/j/YHMqvxxv4) |
| 2:15 PM | Zoom call opens (access information will be available on Eventbrite and in Gather.town) |
| 2:30 PM | Welcoming Remarks, Lars Grabow (SWCS Chair) |
| 2:35 PM | 2020 SWCS Excellence in Applied Catalysis Award, Ye Xu (Chair of Award Selection Committee) |
| 2:40 PM | Stephen W. King, Senior Research Fellow (retired), The Dow Chemical Company,
<i>Advances in the Catalyzed Reductive Amination of Monoethanolamine</i>
Winner, 2020 SWCS Excellence in Applied Catalysis Award |
| 3:30 PM | Interactive Poster Competition on Gather.town |
| 5:30 PM | Adjourn |

2020 SWCS EXCELLENCE IN APPLIED CATALYSIS AWARD

Advances in the Catalyzed Reductive Amination of Monoethanolamine

Stephen W. King, Ph.D.

Senior Research Fellow (retired)

The Dow Chemical Company

Commercially, a significant amount of ethylenediamine (EDA) is produced by reductive amination via the continuous reaction of monoethanolamine (MEA) and ammonia in the presence of hydrogen over a fixed bed catalyst. The reaction scheme quickly becomes quite complex since EDA can further react with MEA to produce diethylenetriamine (DETA), which can also react further to produce piperazine (PIP) and higher amines. These consecutive reactions, coupled with other undesired reactions (hydrogenolysis, decarbonylation, disproportionation, etc.) increases manufacturing costs due to the challenging separation of these byproducts. A significant amount of research has been done to improve this important industrial process. This presentation will give a high level overview of research on reductive amination catalysts that have improved the activity and the selectivity to EDA.



Biography

Steve joined Union Carbide Corporation after receiving his Ph.D from the University of Georgia in 1981 and retired from the Dow Chemical Company in 2019. During his industrial career, Steve was involved in the innovation of the narrow molecular weight (NMW) catalyst technology for the production of NMW surfactants, improved reductive amination (RA) catalysts for the production of ethyleneamines, novel routes to ethers through decarboxylation of carbonates, the development of splittable surfactants, and the commercialization of a new process (transamination) for the production of diethylenetriamine (DETA).

Steve is recognized for his expansive breadth and depth of technical expertise and commercial accomplishments across a broad array of technologies from alkoxylation, reductive aminations, etherifications, transaminations, and process and application development which has led to over 75 granted U.S. Patents. In addition, he was a mentor for many young scientists across Dow and frequently participated in innovation sessions with strategic customers in search of solutions to complex problems.



A Brief History of the Southwest Catalysis Society

As recounted by **Joe W. Hightower**, Professor Emeritus, Rice University (April 2009)

B.S. '59 - Harding University; M.S. '61 and Ph.D. '63 - The Johns Hopkins University

I came to Rice University from the Mellon Institute in Pittsburgh during the summer of 1967 and immediately set out to meet catalyst people in the area. We announced an organizational meeting to be held at Rice, **Fall 1967**. There were 63 people as charter members of what was to become the Southwest Catalysis Club. Jim Richardson (Esso Research and Engineering, now University of Houston) drafted the Bylaws and was elected Vice President, Jack Lunsford (Texas A&M University) was Secretary, Paul Conn (Shell Oil) was the Treasurer, and I served as the first elected President. The officers held the first all-day Spring Symposium in May 1968 in the Grand Hall at Rice, and the SWCS was off and running (42 years and counting!). [As a note, I did my PhD thesis research with **Professor Paul Emmett** at Johns Hopkins, which involved isotopic tracer studies of secondary reactions that occur during catalytic cracking of petroleum products.]

At the time we started, there were about half a dozen “Catalysis Clubs” scattered around the country: Chicago, Pittsburgh, New York, Philadelphia, California, and perhaps one more. I knew people in all these “Clubs” though groups like the Gordon Research Conferences on Catalysis, and they all encouraged us to start a club in the SW. **Why 5 states?** Texas was obvious. Arkansas was included because of Sam Siegel (Chemist at UArk); Louisiana, because of several researchers at Esso in Baton Rouge; Oklahoma, because of several Phillips researchers in Bartlesville; and New Mexico, because of people at University of New Mexico and at Sandia National Labs in Albuquerque. In spite of the long distances, people from all these places attended some of the early meetings held twice a year, which sometimes had attendance near 200. Most of the early meetings were held at Rice or in the Auditorium at the Shell-Westhollow labs. In later years, the meeting was held in nearby places like Austin, College Station, and New Orleans.

What was going on that made the late 60s an optimal time to establish the SWCS? I think the biggest factor was Shell downsizing its labs in Emeryville, CA and moving most its catalysis people to a new research facility at Westhollow. At the same time, Esso was increasing its applied catalysis work both in Baytown 30 miles east of the city and in Baton Rouge. For several years, Phillips Petroleum had been accumulating an amazing number of patents in catalysis at their laboratories in Bartlesville. Bob Eischens came from New York and was applying his pioneering infrared studies at Texaco in Port Arthur. Celanese had several catalysis people doing research near Corpus Christi. Many of you may recall that Texas City was devastated by the largest US chemical plant explosion of an ammonium nitrate ship in the mid-40s. After the explosion, Monsanto rebuilt its facilities there, where workers were doing research on improving catalytic processes for styrene and acrylonitrile manufacture. Petrotex Chemical in Pasadena, another suburb on Houston's ship channel, was optimizing its butadiene and C₄ olefins production through catalytic processes.



In addition, catalysis groups were springing up at several universities, including surface science by the late John Mike White at the University of Texas, Jack Lunsford's and Wayne Goodman's highly productive groups at Texas A&M, Richard Gonzales at Tulane, Jim Richardson at U of H, Kerry Dooley at LSU, Tom Leland and me at Rice, and groups at other universities in the 5-state area. What was lacking? There was no formal mechanism for these diverse groups to exchange information or get advice in the southwest. The time was ripe for an organization where catalysis could be openly discussed. Although much catalysis research is proprietary, enough was sufficiently open to create a stimulating environment for sharing mutual interests, many focusing on new ultra-high vacuum analytical equipment that was being rapidly developed.

The first thing we did was to organize an NSF-supported workshop at Rice which (not surprisingly) concluded that more funding was needed for research on catalysts for fuels, environmental protection (cat converters), chemicals, etc. At that time, demand was also great for new employees with catalysis training, but the supply was quite limited. This provided an occasion for the development of short courses to train industrial employees in heterogeneous catalysis. Several courses were started around the country. One of the most successful was started at Rice and has continued for more than 30 years through the University of Houston. It can be said, then, that **SWCS was instrumental in starting these heterogeneous catalysis short courses.**

The "Club" was soon invited to join the other half dozen Clubs as a part of the growing North American Catalysis Society. Being the new kid on the block, our Club was asked to host its first biennial North American Meeting (NAM-2) in February 1971, which was held at the Astrodome Hotel in Houston. Jim Richardson and I were Associate and General Chair of the meeting, while Paul Venuto (Mobil Research/Development and a colleague of the late Heinz Heinemann) was in charge of the Program. At that meeting the late Dr. R. J. Kokes (one of my professors at Johns Hopkins) and Dr. H. S. Bloch (Universal Oil Products) were recipients, respectively, of the first Paul H. Emmett and Eugene J. Houdry Awards in fundamental and applied catalysis.

In 1985, the Southwest Catalysis Society was again called on to host a five-day 9th North American Meeting (NAM-9) at Houston's Adam's Mark Hotel. This time, Jack Lunsford and Lynn Slauch were General and Vice Chair; I was Technical Program Chair. Most recently, the SWCS members organized the spectacular North American Meeting at Houston's downtown Hilton Americas Hotel in 2007, attended by over 1000 delegates from all over the world, "Celebrating Catalysis Texas Style." Kudos again to SWCS officers Kerry Dooley, Brendan Murray, Scott Mitchell, Michael Reynolds, Yun-Feng Chang, Michael Wong, and many, many others! **All told, the SWCS has hosted 3 national events now: 1971 (NAM-2), 1985 (NAM-9) and 2007 (NAM-20).**