Volume 110, No. 1 January 2023

THE CHEMICAL BULLETIN

Chicago Section of the American Chemical Society Newsletter

Joint Chicago AIChE* and ACS Hybrid Meeting

Thursday, January 19, 2023 5:30–8:35 PM CT

A New Era in Solar Energy Conversion Enabled by Perovskites

Dr. Mercouri Kanatzidis

Charles E. and Emma H. Morrison Professor of Chemistry
Northwestern University

ABSTRACT

Two- and three-dimensional halide perovskites are a class of organic–inorganic compounds that are outstanding semiconducting materials due to their superior carrier lifetime and structural diversity. These materials have demonstrated record-breaking efficiencies in solar cell performance, light-emitting devices, and radiation detection. They have also defined a new, expanding field of optoelectronic device research requiring systematic understanding of the effects of organic spacers on their structure, properties, and device performance. This presentation will focus on current knowledge of structure–property relationships for incorporating organic spacer cations to stabilize crystalline perovskites for use in optoelectronic devices.

IN-PERSON DINNER

$40 for ACS & AIChE members
$45 for nonmembers
$25 for students
Lecture-only is free (on-site or online)

Reza's Restaurant
1557 Sherman Ave.
Evanston, IL 60201
https://rezarestaurants.com/

REGISTRATION

By phone (847-391-9091), email (chicagoacs@ameritech.net) or online:

REGISTER HERE

DEADLINE TO REGISTER

Friday, January 13 at 12 PM (Buffet Dinner)
Wednesday, January 18 at 11 AM (Lecture-only)

THE JANUARY MEETING WILL BE IN PERSON AND VIRTUAL

*American Institute of Chemical Engineers

IN THIS ISSUE

MEET THE SPEAKER

Mercouri Kanatzidis was born in Thessaloniki, Greece in 1957. After obtaining a B.Sc. from Aristotle University in Greece, he received his Ph.D. in Chemistry from the University of Iowa in 1984. He was a post-doctoral research associate at the University of Michigan and Northwestern University from 1985 to 1987 and is currently the Charles E. and Emma H. Morrison Professor of Chemistry at Northwestern University. Dr. Kanatzidis moved to Northwestern in the fall of 2006 from Michigan State University, where he had been a University Distinguished Professor of Chemistry since 1987.

Prof. Kanatzidis holds a dual appointment as Senior Scientist at Argonne National Laboratory and is the Editor-in-Chief of the *Journal of Solid State Chemistry*. He was recently named a 2022 Global Energy Prize Laureate, which recognizes outstanding scientific research and technical developments in the field of energy that promote greater efficiency and environmental security for energy sources on Earth in the interests of all mankind. Mercouri is the laureate in the Non-conventional Energy category: for major advances made in solar energy conversion with the use of novel perovskite halides.

FROM THE EDITORS' DESK

A New Beginning

A joyous Happy New Year to the readers of *The Chemical Bulletin*! We hope you were able to ring in the new year in good health and spirits. Many of you may be refreshed after a well-deserved break from school, work, and volunteering. Hopefully, you were able to spend some quality time with friends and family, which is always good for the heart, mind, and body.

Photo credit: https://www.pexels.com/photo/happy-new-year-text-3334355/

We would like to welcome the new Chicago ACS elected officials. We can't wait to see what you have in store for us in 2023! A very big thank you to the 2022 officials for all of their dedication and hard work. The camaraderie and end results make the time spent on ACS activities worthwhile.

The Chicago Section is always looking for more volunteers, peers, and friends—please join our wonderful group of scientists. We have more than a dozen main committees and over two dozen subcommittees that you can join. *The Bulletin* is also happy to welcome new contributors, so consider submitting an article, drawing, poem, or advertisement.

Our sincere thanks to the following individuals for their contributions to this issue: Paul Brandt, Helen Dickinson, Ken Fivizzani, Josh Kurutz, Raelynn Miller, Sherri Rukes, and Margaret Schott.

—AMBER ARZADON AND IRENE CESA

AGENDA

5:30–6:20	Check-in Social Hour
6:20–7:15	Buffet Dinner
7:15–7:30	Announcements
7:30–8:30	Technical Presentation with Q&A
8:30–8:35	Closing Remarks

DINNER

Buffet menu:

- Roasted feta cheese
- Hummus
- Grilled mushrooms
- Persian salad
- Filet mignon shish kabob
- Chicken kabob
- Vegetarian feast
- White and dill rice
- Persian tea

Cash bar for soda and alcoholic drinks

LETTER FROM THE CHAIR

A Positively Charged New Year

The beginning of a new year often elicits wishes of goodwill toward others and optimism for what lies ahead. This year is no different, and we have much to look forward to as an ACS Local Section. Talent continues to emerge from among the approximately 3000 members in the greater Chicago area and northwest Indiana. And as the pandemic abates, Chicago Section meetings and programs will continue to migrate back to being held in person.

The past year was full to the brim with exciting outreach activities including of course the Chicago Section's hosting of the Fall 2022 National ACS Meeting. Our outgoing Chair, Mark Cesa, has done a wonderful job of summarizing the year's highlights (see December 2022 issue). Mark's steady, insightful and energetic leadership have served us well; he combines a positive outlook with prudential judgment and a spirit of collaboration in all he does. Thank you, Mark, for a job very well done.

I would also like to thank Sherri Rukes for her tremendous service to the Chicago Section. Sherri just completed three years in the sequence of serving as Chair-Elect, Chair, and Past Chair. Congratulations, Sherri, and huge thanks for your exemplary contributions in so many ways.

It will be a privilege for me to serve as Chair of the Chicago ACS Section for 2023. Although I was not "aiming" to hold this position, I do believe that membership in an organization also implies a willingness to serve in some capacity. I look forward to working with our section's outstanding volunteer board members. We are fortunate to have both depth of experience as well as new blood represented. All section members are welcome to attend the monthly board meetings and to get involved.

The basic structure of the Chicago Section falls into five areas of involvement that we term Divisions: Administration (planning, arrangements, and policy), Science (monthly programs, awards, regional meeting), Education and Outreach (K–12/College, public affairs, outreach in its many forms), Membership (YCC/WCC/seniors, employment), and Communication (newsletter, section history, social media).

To borrow an analogy from quantum physics, we do **not** have a "many-body problem!" Rather, we welcome "many bodies" to get involved in the section's numerous endeavors related to chemistry and its practitioners. So why not start by volunteering for an outreach event, or contacting a committee chair, and see for yourself? If you are reading this and have even the slightest inclination to link up with a group of chemists making a difference, please contact me at chair@chicagoacs.org. You can also check the opportunities listed at https://chicagoacs.org/form.php?form_id=11. You will be glad you did!

Let me close by sharing a few initiatives I plan to address as Chair:

- Continue transitioning back to in-person monthly meetings and strive for a diversity of presenters.
- Grow the section's membership in order to share the resources and benefits ACS has to offer.
- Plan and host educational events for interested adults in our communities.

Thanks for reading!
—MARGARET SCHOTT

A warm invitation or stern directive?

The following is taken with minor modifications from an editorial by J. A. Hynes in the October 1919 issue of The Chemical Bulletin.

A new year for the Section is just beginning. Whether it will be a success or dismal failure depends upon YOU. The coming year has great possibilities. If YOU do your part, the year will be marked as one of achievement.

When you joined the Section you implied that you were willing to GIVE as well as receive. If you want concrete suggestions for doing your share, here are a few:

(1) Attend the monthly meetings.
(2) Contribute an article for the Bulletin.
(3) Make yourself known at the meetings, and greet other attendees.
(4) Bring in a new member during the year.

OUTREACH

Have a Project SEED Summer!

As temperatures drop and snow begins to fall, let's talk SUMMER! Want to bring your STEM knowledge to an ambitious high school student this summer? Project SEED is a highly successful ACS program that matches enthusiastic high school students interested in chemistry with mentors from academia and industry.

"The students are highly motivated and very willing to learn…"

–A current mentor

Mentors are key to the success of Project SEED! Are you working on an exciting project that can be partitioned into segments suitable for high students to work on? Any individual involved in scientific work can be a mentor, including scientists from academia, industry, and nonprofit or government organizations. Double the fun? Each mentor can take on two interns, if desired. **Project proposals from potential mentors must be submitted by January 31, 2023 for approval.**

ACS PROJECT SEED

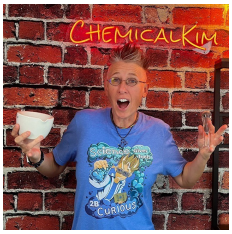
Student eligibility includes low-income background with at least one high school chemistry class completed. Project SEED students work on their projects for eight weeks, 40 hours/week, over the summer, and are eligible for up to two summers of support. **Student applications open in February.** Please visit the program website at www.acs.org/projectseed or contact Raelynn Miller at chicagoacsprojectseed@gmail.com for more details.

–RAELYNN MILLER

PAST MEETING

December Holiday Party

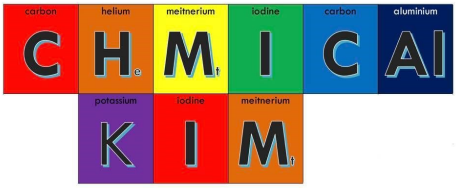
Kim Hilton, aka "Chemical Kim" from Florida SouthWestern State College, was our featured (and highly entertaining!) speaker at the December 2022 Chicago ACS Holiday Party. As had been long-standing custom, the Holiday Party was held jointly with members of the former Chicago Chemists Club and Iota Sigma Pi, the National Honor Society for Women in Chemistry. It was a delight to mix and mingle with our friends at the first in-person holiday gathering since 2019.



Chemical Kim was the 2022 recipient of the ACS Helen M. Free Award for Public Outreach, and she demonstrated her passion for science education and outreach to "children" of all ages (that is, us!) with a series of hands-on, interactive activities. Members and guests in attendance performed these fun, safe activities at their tables using special goodie bags prepared by the presenter.

In keeping with the party theme, the festive activities included using silly putty to make wires, connect them to a battery, and light up a string of holiday lights; making "instant snow" with sodium polyacrylate and water, and then dissolving the snow with salt; and creating special holiday party poppers from the reaction of baking soda with vinegar. The evening concluded with oohs and aahs from the audience as Kim demonstrated dry ice cannons made from PVC pipe.

Chemical Kim is a very active and popular content creator with thousands of followers across all social media platforms, including YouTube, Twitter, LinkedIn. Check out her sites to learn more and get excited about science again!



PAST MEETING

Scenes from the December Holiday Party

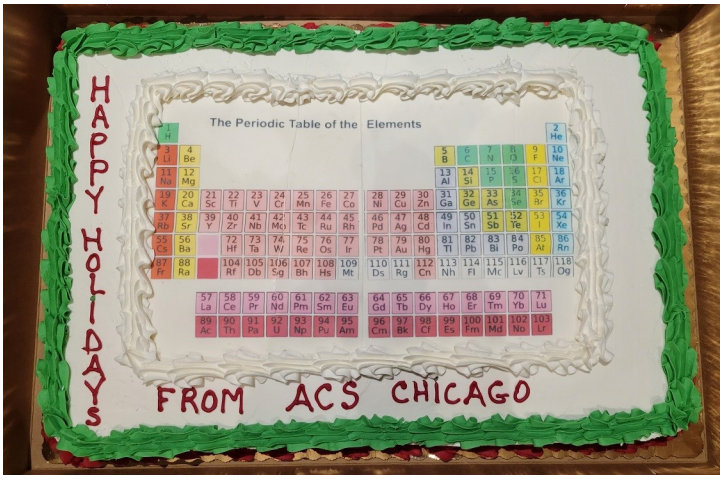
A festive scene awaited members and guests at the Holiday Party!

Our featured speaker, Chemical Kim (L), captivated guests even before her presentation.

Mark Cesa, 2022 Chair, receiving his Past Chair Pin from incoming 2023 Chair, Margaret Schott (L).

Patti Conn, Sherri Rukes (2021 Chair), and Josh Kurutz (L to R).

Michael Koehler (L) and Avrom Litin look forward to the presentation after dinner.



Happy Holidays from the ACS Chicago Section!

2023 Chair-elect Vivian Sullivan (R) with friends from Iota Sigma Pi.

SAFETY FIRST

What are microplastics, and why are they everywhere?

Microplastics, which are defined as plastic particles less than 5 mm in size, are everywhere. Since the term was coined by an English marine biologist in 2004, microplastics have been found everywhere that scientists have looked for them – in air, water, food, and soil, as well as the human body and wildlife. Where do microplastics come from, and what are their possible environmental and health hazards?

There are two main sources of microplastics in the environment. **Primary microplastics** originate from commercial products containing polymer microbeads that have been added for a specific function, such as exfoliants in cosmetic formulations. Microbeads in cosmetics may be rinsed off directly into the sewage system during washing and are generally not retained by filtration in water treatment plants. In 2015, the United States passed the Microbead-Free Waters Act to eliminate the use of microbeads in personal care products. Other countries that have curtailed the use of microbeads in cosmetics include the United Kingdom, France, Canada, and India. While positive, these developments are offset by increases in the use of plastic microbeads in industrial products, such as drilling fluids for oil and gas exploration. Resin losses in the manufacture of molded plastics are another source of primary microplastics.

Far more pervasive than primary plastic microparticles are **secondary microplastics** that are dispersed into the environment via disposal and degradation of plastic waste. The scale of this problem is enormous due to the ubiquitous presence and exponential rise in the use of plastics in our lives. According to one estimate, the global production of plastics is approximately 400 million metric tons (1000 kg) per year, and this figure is expected to double by 2050.

The breakdown of plastic waste in the environment results from a combination of physical, chemical, and biological processes, including erosion, abrasion, oxidation, decomposition, and UV irradiation.

What are the possible health and environmental risks of microplastics? The short answer is we simply don't know! The scale at which microplastics are distributed in the environment is matched by their complexity. While polyethylene, polystyrene, polyethylene terephthalate, and polyamides are the most common, the number of different plastics produced is significantly greater, and they are typically contaminated with a broad range of additives as well. In addition to chemical composition, the health and environmental hazards of microplastics depend on particle size distribution and their shape and surface chemistry. Given this complexity, many toxicological studies are focused on *in vitro* approaches to simulate both exposure and biological activity. Another important factor in current risk assessment studies is to quantify the level of exposure to microplastics.

References

"Getting a grip on microplastics' risks," C&EN, May 30, 2022 https://cen.acs.org/articles/100/i19/Microplastics-health-risk-toxicology-particle-characterization-nanomaterials.html

"Microplastics in the food chain: How harmful are they?" World Economic Forum, June 2022 https://www.weforum.org/agenda/2022/06/how-microplastics-get-into-the-food-chain/

"Microplastics are in our bodies. How much do they harm us?" National Geographic, April 25, 2022 https://www.nationalgeographic.com/environment/article/microplastics-are-in-our-bodies-how-much-do-they-harm-us

–IRENE CESA

Safety First! is an initiative led by the Environmental and Lab Safety (ELS) Committee of the Chicago ACS Section. The purpose of this program is to model the inclusion of safety as a core value in the chemistry enterprise. Since 2019, ELS has published reports on a broad range of topics in chemical and lab safety, including safety education, consumer safety, and environmental health. See the September 2022 issue of *The Chemical Bulletin* for a partial listing of the more than 35 articles in the **Safety First!** series.

Photo credit: https://www.niehs.nih.gov/research/programs/geh/geh_newsletter/2022/6/spotlight/microplastics_may_increase_risk_for_obesity.cfm

TEACHER RESOURCES

Integrating Physical and Earth Science Standards in the Chemistry Curriculum

https://www.pexels.com/photo/selective-focus-photo-of-pile-of-assorted-title-books-1148399/

Many high school teachers continue to struggle with adapting their ways of teaching to accommodate the conceptual approaches and scientific practices outlined in the Next Generation Science Standards (NGSS). Knowing where and how to start is sometimes the hardest part of the transition to NGSS. Another stumbling block in the transition is how to fit the Earth and Space Science Standards into a traditional chemistry class. Finally, as any teacher can attest, you can't just keep adding new things to the curriculum. You also have to decide what to cut while maintaining student preparedness for future courses.

In my own passion for continuous improvement in my teaching practices, I recently discovered professional development resources available on the website for the San Francisco Unified School District (SFUSD). The website includes a page devoted to the chemistry curriculum within the NGSS framework, which incorporates both the Physical and Earth and Space Science performance expectations

A link to the student edition book on the district website describes how to develop a phenomena-based program and integrate the multidimensional NGSS approach. Each chapter in the book is a separate file, making it easy to navigate. This is a wonderful resource with lots of useful ideas for teachers.

One especially valuable feature of the SFUSD resources is the inclusion of real-world data, observations, and charts. The district has partnered with National Oceanic Atmospheric Administration (NOA), the Department of Energy (DOE), National Optical Astronomy Observatory (NOAO), Office of Environmental Health Hazards Assessment (OEHHA), Action for the Climate Emergency (ACE), National Aeronautics and Space Administration (NASA), TED-Ed and others to use this information in their district schools and classrooms.

Photo credit: https://www.pexels.com/photo/golden-gate-bridge-san-francisco-2104742/

Additional documents on the SFUSD website will help teachers build more robust connections between traditional chemistry topics and both the NGSS and their science and engineering practices.

- Science and skill dependencies
- Chapter organizer with the 5E approach to each unit
- Scope and sequence
- Teaching strategies
- Material list
- Field tester advice

Educators are invited to fill out a form on the website for access to the teachers edition, Word and EPUB versions of student files and support files, as well as copy masters, videos, and much, much more. The resources provide a gold mine of information for both new teachers and seasoned veterans.

—SHERRI RUKES

Professional Development Opportunities for High School Teachers

ACS is now accepting applications for ACS-Hach Professional Development Grants! These grants of up to $1,500 are to support high school chemistry teachers as they identify and pursue opportunities that can advance their professional development and enhance the teaching and learning of chemistry in the classroom. *The deadline for applications is January 21, 2023.*

CHEMSHORTS FOR KIDS

The Invisible Crushing Bottle

Did you know that you can crush a bottle just by thinking about it? (Well, that and a little science!)

Materials

Hot water from the tap or heated on the stove or in a microwave

Plastic water/soft drink bottle (#1 – PET recycled plastic) with a screw-on cap. *Hint:* The flimsier the plastic, the more drastic the results will be.

Optional: Ice water

Be Safe!

Adult supervision is necessary when working with hot water.

Experiment

Pour hot water into the bottle until it is about one-quarter full. Put the cap on and shake the bottle to disperse the hot water throughout the bottle. Do this for about 10 seconds. Take off the top, pour out the hot water, and quickly recap the bottle. Set the bottle down and observe what happens. **Your observations should include both what you see AND hear!** For a more dramatic effect, place the bottle in ice water, the freezer, or outside in a snowbank.

What's happening?

If someone asks you what's in an empty bottle, what would you say? Ideally, your answer would be air! There are MANY molecules of nitrogen and oxygen gas (air) in an "empty" bottle. Adding hot water to the bottle causes those gas molecules to heat up.

As you heat up the gas molecules they also begin to move faster and take up more space. When you then pour out the hot water and recap the bottle, you've now trapped those hot air molecules in the bottle. Before long, the molecules begin to cool and slow down, which reduces the pressure of the gas molecules inside the bottle. As this happens, the normal air pressure outside the bottle continues to press on the bottle at a force of 15 pounds for every square inch of the bottle's surface area. That is equal to about 850 pounds of force on the outside of the bottle. So, if there were no air molecules left inside the bottle, you could imagine that the bottle would be totally crushed. Because you didn't eliminate all the air molecules, the bottle only partially collapses. Now, if only you can convince your friends that you crushed the bottle using only your mental powers!

References

https://spark.iop.org/collapsing-bottle

To view past "ChemShorts for Kids" activities, go to: https://chicagoacs.org/ChemShorts

—PAUL BRANDT

AWARDS

Local Student Wins National Poetry Contest

Congratulations to Akshara K., who represented the Chicago ACS at the National Chemistry Week (NCW) Illustrated Poem Contest at the national level. The 2022 NCW theme was "Fabulous Fibers: The Chemistry of Fabrics."

Akshara placed first in the national ACS contest in the 6th–8th grade category. Her poem is featured on the ACS website: https://www.acs.org/content/acs/en/education/outreach/ncw/plan-an-event/illustrated-poem-contest/winners.html.

APPLY NOW

ACS SUMMER SCHOOL ON GREEN CHEMISTRY & SUSTAINABLE ENERGY

The ACS Summer School on Green Chemistry & Sustainable Energy is a week-long once-in-a-lifetime experience! Attend lectures, hold discussions, participate in a poster presentation, and network at the Colorado School of Mines. All eligible travel and program costs are covered.

Application Deadline: January 30, 2023
Level: Graduate Students & Postdoc
Learn more: https://www.acs.org/greenchemistry/students-educators/summer-school.html?cid=em_gci_gci_12_5_22

Register for the IUPAC 15th Green Chemistry Postgraduate Summer School in Venice, Italy from July 2-7, 2023. Attend five days of lectures, learn about state-of-the-art research in green chemistry, present your research in a poster session.

Application Deadlines Start: February 28, 2023
Level: Graduate Students & Postdoc
Learn more: https://www.greenchemistry.school/

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https://americanchemical.co1.qualtrics.com/jfe/form/SV_426IgjC8ggjADTE

UPCOMING EVENTS

January 10	Articles due for the February 2023 *Bulletin* issue
January 12	Chicago Board of Directors Meeting
January 19	Chicago ACS Monthly Program Meeting, Joint with AIChE
January 20	ACS Leadership Institute Atlanta, GA
February 9	Chicago Board of Directors Meeting
February 10	Articles due for the March 2023 *Bulletin* issue
February 17	Chicago ACS Monthly Program Meeting

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EDITORS
Amber Arzadon and Irene Cesa
editor@chicagoacs.org

DIGITAL EDITOR
Josh Kurutz

PROOFREADERS
Helen Dickinson and Ken Fivizzani

2023 Chicago ACS Section Officers

Chair	Margaret Schott	chair@chicagoacs.org
Vice Chair	Paul Brandt	vice-chair@chicagoacs.org
Chair-Elect	Vivian Sullivan	chair-elect@chicagoacs.org
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How to reach us

office@chicagoacs.org
https://chicagoacs.org

1400 Renaissance Drive
Suite 312
Park Ridge, IL 60068
(847) 391-9091