台灣氣膠研究學會

Taiwan Association for Aerosol Research

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TAAR Newsletter is a quarterly publication by the Taiwan Association for Aerosol Research

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Date November 15 2024

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Announcement

- The first joint meeting of the 17th Board of Directors and Supervisors was held on September 20, 2024. During this meeting, the results of the member application review were announced. This season, there were 13 applications for individual membership, including 3 permanent members, 8 junior members, and 2 regular members. These new members have become permanent, regular, and junior members of the Taiwan Aerosol Society. We welcome them to join the Taiwan Aerosol Society!
- The first General Assembly of the 17th Taiwan Aerosol Society was successfully held on September 20, 2024, at National Ilan University. We thank all members for their participation.

Permanent Individual Member

Yueh-Chen Wang

Postdoctoral researcher

The Department of Atmospheric Sciences, National Central Universit

Chen Hung Chang

Assistant manager

PerfectDoubleSS Ltd.

Yu-Lun, Tseng

Postdoctoral researcher

Institute of Environmental Engineering, National Sun Yat-sen University

Announcement

Junior Member

TRAN MINH HUAN

PhD Student

Global Health and Health Security, Taipei Medical University

Che-Wei Wu

PhD Student

Department of Environmental Engineering, National Cheng Kung University

Ming-Yu Hung

Master Student

Department of Occupational Safety and Health, China Medical University

Shi-Ya Tang

PhD Student

Department of Occupational Safety and Health, China Medical University

Yi-Hsuan Chen

Master Student

Department of Occupational Safety and Health, China Medical University

Announcement

Junior Member

Yi-Hsuan Liu

Master Student

Master Program in Thoracic Medicine, School of Respiratory Therapy Taipei Medical University

Cheng Man Yan

Master Student

Department of Public Health, Kaohsiung Medical University

Anggraini Widyastuti

Master Student

Environmental Engineering, Chung Yuan Christian University

Regular Annual Member

Yu-Syuan Shih

PhD Student

College of Medicine, Taipei Medical University

Yu-Ting Chang

PhD Student

Department of Environmental Science and Engineering, National Pingtung University of Science and Technology

Calendar of Events

Date
31 August-5 September 2025

Conferences
EAC 2025 EUROPEAN AEROSOL CONFERENCE

Location
Lecce, Italy

Website
https://eac2025.iasaerosol.it/

Date
October 13-17, 2025

Conferences
AAAR 43rd Annual Conference

Location
Buffalo, New York

Website
https://www.aaar.org/meetings-events/meetings-and-events/

17th the list of elected directors and supervisors

• President	Shih-Chun Lung
• Executive Director	Kai Hsien Chi
• Executive Director	How-Ran Chao
• Director	Yu-Chieh Ting
• Director	Hung-Lung Chiang
• Director	Sheng-Lun Lin
• Director	Hsing-Cheng His
• Director	Ken-Hui Chang
• Director	Chang-Tang Chang
• Director	Yi-Ming Kuo
• Director	Yu-Cheng Chen
• Director	Wei-Hsin Chen
• Director	Li-Hao Young
• Alternate Director	Pei-Shih Chen
• Executive Supervisor	Perng-Jy Tsai
• Supervisor	Jheng-Jie Jiang
• Supervisor	Yuan-Chung Lin
• Supervisor	Chun-Chi Chen
• Supervisor	Kuo-Lin Huang
• Alternate Supervisor	Hsiao-Chi Chuang

17th working committee

• President	Shih-Chun Lung
• First Vice President	Ta-Chih Hsiao
• Second Vice President	Lin-Chi Wang
• Secretary General	Yen-Ping Peng
• First Deputy Secretary General	Yu-Chieh Ting
• Second Deputy Secretary General	Chia-Hua Lin
• Third Deputy Secretary General	Guan-Yu Lin
• Chief Financial Officer	Sheng-Hsiang Wang
• Long Term Planning Committee/Chairman	Wen-Jhy Lee
• Medal Award Committee/Chairman	Chung-Te Lee
• International Affairs Committee/Chairman	Chia C. Wang
• Organizing Committee/Chairman	Pei-Shih Chen
• Gender Committee/Chairman	Fang-Yi Cheng
• Cross-strait Exchanges Committee/Chairman	Sheng-Lun Lin
• Industry-academia Cooperation Committee/ Chairman	Chang-Tang Chang
• Members Committee/Chairman	How-Ran Chao
• Newsletter Committee/Chairman	Hsiao-Chi Chuang
• Internet Committee/Chairman	Chih-Da Wu
• Social Responsibility Committee/Chairman	Yu-Cheng Chen
• Finance Committee/Chairman	Sheng-Hsiang Wang
• Southeast Exchange Committee/Chairman	Kai Hsien Chi
• Education Committee/Chairman	Ming-Yeng Lin

The 31st International Conference on Aerosol Science and Technology, 2024 Conference on Fine Particulate Matter ($PM_{2.5}$) and Net Zero Emissions Issues

Organizers/Co-organizers:
Taiwan Association for Aerosol Research
Ministry of Environment
Institute of Labor, Occupational Safety And Health, Ministry of Labor
National Ilan University
Department of Environmental Engineering, National Ilan University

The 2024 ICAST conference was held at National Ilan University

Keynote speaker I

Kihong Park

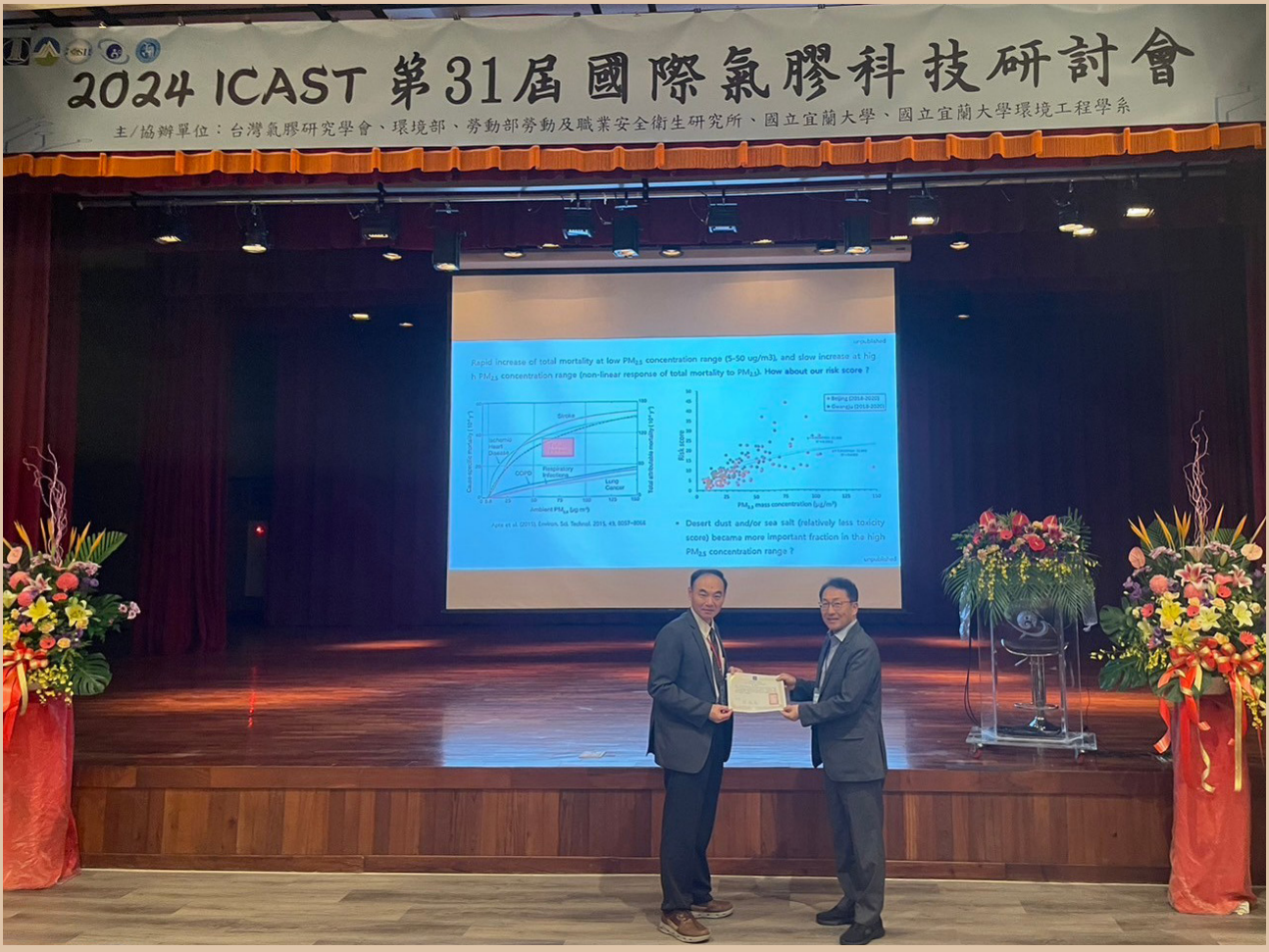
School of Earth Science and Environmental Engineering Gwangju Institute of Science and Technology (GIST), Korea

Work Experience

2023~present President, Korean Associate for Aerosol and Particle Research (KAPAR), Korea
2020~present Adjunct professor, AI graduate school, GIST, Korea
2016~present Director, PM2.5 characterization center, GIST, Korea
2021~2023 Dean of Research Affairs, GIST, Korea
2021~2023 Director of Research Innovative Center, GIST, Korea

Topic

From equal to differential toxicity for fine particles



A photo of Ying-Yi Tsai, President of the Taiwan Association for Aerosol Research, with Professor Kihong Park

Keynote speaker II

NGA LEE NG

Love Family Professor School of Chemical and Biomolecular Engineering School of Earth and Atmospheric Science Georgia Institute of Technology

Work Experience

2021~2022 Professor and Tanner Faculty Fellow, School of Chemical and Biomolecular Engineering, School of Earth and Atmospheric Sciences, Georgia Institute of Technology

2017~2021 Associate Professor and Tanner Faculty Fellow, School of Chemical and Biomolecular Engineering, School of Earth and Atmospheric Sciences, Georgia Institute of Technology

2011~2017 Assistant Professor and Baldwin Faculty Fellow, School of Chemical and Biomolecular Engineering, School of Earth and Atmospheric Sciences, Georgia Institute of Technolog

Topic

Atmospheric Science and Chemistry mEasurement NeTwork (ASCENT): Advanced, Ground-based Aerosol Measurement Network Across the United States

A photo of Professor Neng-Huei Lin with Professor Nga Lee Ng

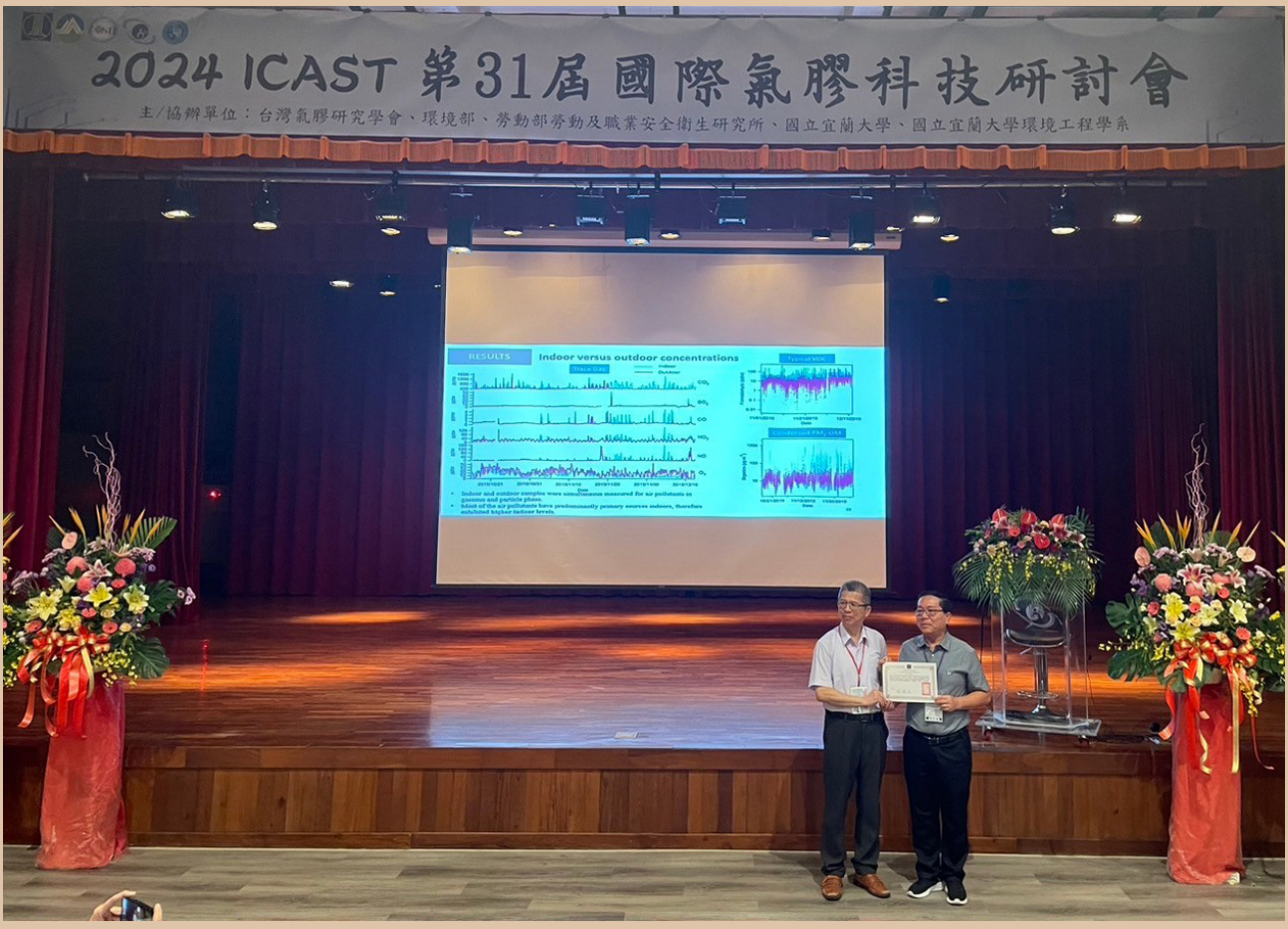
Keynote speaker III

Hai Guo

Hong Kong Polytechnic University professor

Work Experience

Jul. 2016 - Present	Professor, Hong Kong Polytechnic University, Hong Kong
Apr. 2021 - Present	Changjiang Chair Professor, Wuhan University
Jul. 2012 - Jun. 2016	Associate Professor, Hong Kong Polytechnic University, Hong Kong
Jan. 2007 - Jun. 2012	Assistant Professor, Hong Kong Polytechnic University, Hong Kong
Aug. 2005 - Dec. 2006	Research Fellow, Queensland University of Technology, Australia
Aug. 2004 - Jul. 2005	Air quality Specialist, University of California at Irvine, USA
May. 2001- Jul. 2004	Research Fellow, Hong Kong Polytechnic University, Hong Kong
Apr. 1999 - Apr. 2001	Associate Research Scientist, New York University, USA
Jul. 1988 - Mar. 1995	Environmental Scientist, Guangzhou Institute of Environmental Protection, China



A photo of Professor Neng-Huei Lin with Professor Hai Guo

Keynote speaker IV

Mihir Kumar Purkait

Chair Professor, National Jal Jeevan Mission (NJJM). Govt. of India.

Work Experience

Jan. 2021 - Mar. 2024	Dean, Alumni and External Relations, Indian Institute of Technology Guwahati
Mar. 2022 - Mar. 2027	Chair Professor, National Jal Jeevan Mission, Govt of India
May 2018 - Feb. 2021	Head, Centre for the Environment, Indian Institute of Technology Guwahati
Jul. 2015 - Present	Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati
Nov. 2008 - Jun. 2015	Associate Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati
Sep. 2005 - Nov. 2008	Assistant Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati
Dec. 2004 - Sep. 2005	Senior Lecturer, Department of Chemical Engineering, Indian Institute of Technology Guwahati

Topic

Recent Global Trend in Aerosol Research

A photo of Professor Chang-Tang Chang with Professor Mihir Kumar Purkait

Keynote speaker V

Mohd Talib Latif

Department of Earth Sciences and Environment, Faculty of Science and Technology, Universiti Kebangsaan Malaysia

Work Experience

Dec. 2013 - Present	Professor, Universiti Kebangsaan Malaysia
May 2015 - Dec. 2017	Deputy Director, Institute for Environment and Development (Lestari)
Aug. 2009 - Dec. 2013	Associate Professor, Universiti Kebangsaan Malaysia
Jan. 2010 - Jan. 2013	Head Environmental Science Programme, Universiti Kebangsaan Malaysia

Topic

Impact of Regional Haze on Air Quality in Malaysia

A photo of Associate Professor Yu-Chieh Ting with Professor Mohd Talib Latif

Keynote speaker VI

Alvin R. Caparanga

Dean - School of Graduate Studies Mapua University

Work Experience

2024 - present	Dean -School of Graduate Studies Mapua University
2024 - present	Director and Sustainability Officer - Mapua Institute for Global Sustainability Mapua University
2017 - present	School of Chemical, Biological, and Materials Engineering and Sciences
2003 - present	School of Graduate Studies
2018 - present	Chair, Graduate Programs in Environmental Engineering,Mapua University, Manila, Philippines
2017 - 2024	Dean -School of Chemical, Biological, and Materials Engineering and Sciences (CBMES) Mapua University, Manila, Philippines

Topic

Understanding the effect of atmospheric aerosols on the fate and transport of fine microplastics in the air

Keynote speaker VII

Joni Hermana

Department of Environmental Engineering, Laboratory of Air Pollution Control and Climate Change, Institut Teknologi Sepuluh Nopember (ITS).
Research Center for Infrastructure and Sustainable Environment (ILB).

Work Experience

- As a Rector of highly reputable autonomous university (ITS-PTNBH), he created breakthrough within its academia, by introducing leadership by values, that underlines cohesiveness and being together are important factors in the development of university with three main strategic targets, namely transformation, national contribution and world class university. With this approach he was able to increase the academic performance of ITS among the best universities in Indonesia.
- As a professor, he has a higher degree of experience in training and research activities; coupled with experience in senior institutional level as the Dean of the Civil Engineering and Planning Faculty of ITS during 2003—2011 and then as the Rector of ITS during 2015-2019 mainly on leading, strategic planning, managing and controlling. It had been supported from his long experience as a head of study program in the environmental engineering postgraduate program since 1999.

Topic

Decarbonizing Indonesia's Coal-Fired Power Plants

A photo of Associate Professor Yu-Chieh Ting with Professor Joni Hermana

Keynote speaker VIII

Wan Wiriya

Assistant Professor Department of Chemistry, Chiang Mai University

Work Experience

As a Rector of highly reputable autonomous university (ITS-PTNBH), he created breakthrough within its academia, by introducing leadership by values, that underlines cohesiveness and being together are important factors in the development.

A photo of Associate Professor Yu-Chieh Ting with Assistant Professor Wan Wiriya

Industry Practice Seminar

Moderator

How-Ran Chao
Professor, Department of Environmental Science and Engineering, National Pingtung University of Science and Technology

Yi-Ta Wang
Professor, Department of Mechanical and Electromechanical Engineering, National Ilan University

Speakers

Chih-Cheng Hsiao
Manager, Taiwan Cement Corporation Hoping Branch

Yi-Chan Wu
Director, Department of Environmental Assessment, Formosa Plastics Group

Jui-Pin Cheng
Vice President, Ruentex Materials Co., Ltd.

Tzu-Hao Kuo
Project Manager, Sinotech Engineering Services, Ltd.

A photo of the moderators and speakers of the Industry Practice Seminar

Net Zero Carbon Emissions Forum

Moderator

Yuan-Chung Lin
Distinguished Professor, Institute of Environmental Engineering, National Sun Yat-sen University

Chin-Jung Lin
Professor, Graduate Institute of Environmental Engineering, National Central University

Speakers

Wei-Ming Huang
Deputy Director General, Climate Change Administration, Ministry of Environment

Po-Hsiu Lin
President, Fabulous Power Co., Ltd.

Stanly Huang
President, KC Cottrell Taiwan Co., Ltd.

Chung-Yu Guan
School of Forestry and Resource Conservation, National Taiwan University Associate Professor

A photo of Professor Chin-Jung Lin and the speaker, President of KC Cottrell Taiwan Co., Ltd., Stanly Huang

Net Zero Carbon Emissions Forum

A photo of Professor Yuan-Chung Lin and the speaker, President of Fabulous Power Co., Ltd., Po-Hsiu Lin

Air Quality Improvement and Control Strategies Forum

Moderator

Kai Hsien Chi
Professor, Institute of Environmental & Occupational Health Sciences, School of Medicine, National Yang-Ming Chiao Tung University

Gui-Bing Hong
Professor, Department of Chemical Engineering and Biotechnology, National Taipei University of Technology

Speakers

Shun-Chin Chang
Director, Department of Atmospheric Environment, Ministry of Environment

Chia-Chi Hsu
Director General, Environmental Protection Burea, Yilan County

Chia-Chin Wu
Division Chief, Air and Noise Control Section, Bureau of Environmental Protection, Keelung City

Bing-Zong Pan
President, Intelligence Environmental Technology Co., Ltd.

A photo of Professor Gui-Bing Hong and the speaker, Division Chief of the Air and Noise Control Section, Bureau of Environmental Protection, Keelung City, Chia-Chin Wu

A photo of Professor Kai-Hsien Chi and the speaker, Director of the Department of Atmospheric Environment, Ministry of Environment, Shun-Chin Chang

COVID-19 Engineering Controls

Moderator

Sheng-Hsiu Huang

Assistant Professor, Institute of Environmental and Occupational Health Sciences, National Taiwan University

Speakers

Chih-Chieh Chen

Professor, Institute of Environmental and Occupational Health Sciences, National Taiwan University

Chih-Wei Lin

Project Assistant Professor, Institute of Environmental and Occupational Health Sciences,

National Taiwan University

Li-Hao Young

Professor, Department of Occupational Safety and Health, College of Public Health, China Medical University (CMU), Taichung, Taiwan

Aerosol Intelligence Forum

Moderator

Hui-Chen Chien
Deputy Director, Chemicals Administration, Ministry of Environment

Speakers

Eason Li
President, EJ Technology

Chun-Neng Chen
President, JS Environmental Technology and Energy Saving Co., Ltd.

Chih-Da Wu
Professor, Department of Geomatics, National Cheng Kung University
Adjunct Research Fellow, National Institute of Environmental Health Sciences, National Health Research Institutes

Chau-Ren Jung
Assistant Professor, Department of Public Health, China Medical University

A photo of the moderator and speakers of the Aerosol Intelligence Forum

Lists of award winners

Chiu-sen Award

Yu-Chieh Ting
Associate Professor

This medal is awarded in recognition of Professor Yu-Chieh Ting's contributions to the research on "the physicochemical and optical properties of atmospheric aerosols, with particular emphasis on carbonaceous aerosols, source apportionment of air pollutants, the formation mechanisms of secondary pollutants, and the impacts of air quality and climate warming." Professor Ting's future development holds great potential, making him an exemplary figure for young scholars. This award is presented in acknowledgment of his achievements. The prize money is generously donated by Professor Chiu-Sen Wang, and we express our heartfelt gratitude to Professor Wang for his continued support in nurturing future talent.

Best Academic Paper Award

Daren Chen
Professor

This medal is awarded to Jianlong Li, Wenjun Xie, Quanquan Wu, Da-Ren Chen*, Dinglian Shi, Qiang Chen, Zhifei Ma, and Daishe Wu for their paper titled "Improved Pulsed-Jet Cleaning of Pleated Cone Filter Cartridges Using a Diffusion Nozzle," published in the journal Aerosol and Air Quality Research. The paper presents a novel pleated inner cone filter cartridge, achieved by adding an additional pleated filter cone at the base of the cartridge, which enhances both the filtration area and the cleaning performance of the filter material. It was found that, using a diffusion nozzle, the pulsed-jet pressure at the upper portion of the filter cartridges was increased, compared to that of a round nozzle, particularly for cartridges with a low inner cone height and a short jet distance setting. Also could decrease the residual filtration pressure drop, prolong the cleaning interval, and reduce the average dust concentration emission from cone filter cartridges. We hope that this award will encourage the recipients to continue their in-depth research and further promote the application of aerosol science and technology.

Lists of award winners

Best Engineering Paper Award

Sheng-Chieh Chen
Associate Professor

This medal is awarded to Yu Zhang, Zan Zhu, Wei-Ning Wang, Sheng-Chieh Chen*, and others for their paper titled "A Novel Sustainable Semiconductor/Metalorganic Framework Coated Electret Filter for Simultaneous Removal of $PM_{2.5}$ and VOCs," published in the journal Aerosol and Air Quality Research. The study introduces a novel composite filter material, E-MOFilter, which is developed by integrating an electret filter with a metal-organic framework (MOF) material, MIL-125-NH_2. This innovative filter demonstrates a low pressure drop while effectively capturing both $PM_{2.5}$ particles and volatile organic compounds (VOCs). To further enhance its VOC removal performance, the researchers synthesized and applied photocatalytic nanosheets of Bi_2WO_6/BiOCl onto the surface of MIL-125-NH_2, resulting in a new composite filter, named PE-MOFilter. Experimental results indicate that the surface area and microporosity of MIL-125-NH_2 were largely preserved after modification, and the PE-MOFilter not only captured $PM_{2.5}$ and VOCs efficiently but also achieved a significant photocatalytic degradation of VOCs, with an efficiency of up to 68.7%. We hope that this award will encourage the recipients to continue their in-depth research and further promote the application of aerosol science and technology.

Poster Competition

High Distinction Award

Presenter
Po-Kai Chang
Topic
臺灣北部都市近交通源地區微粒肺部沉積表面積量測評估
Creator
張博凱、蕭大智

Excellence Award

Presenter
Yu-Chen Cheng
Topic
再製廢棄球狀活性碳之揮發性有機物吸附探討
Creator
賴郁阡、鄭羽辰、席行正

Presenter
Yu-Jou Tu
Topic
利用相變化材料及含鋅金屬有機框架材料處理揮發性有機物
Creator
杜郁柔、張章堂

Honorable Mention Award

Presenter
Yueh-Chen Wang
Topic
利用多部氣膠光達解析臺灣大氣邊界層特性及其對地面空氣品質之影響
Creator
王悅晨、王聖翔、游智淵

Presenter
Jun-Yu Lu
Topic
使用衛星監測資料修正東亞地區空氣污染物排放量並探討境外污染傳輸對臺灣影響
Creator
呂峻宇、鄭芳怡

Poster Competition

Honorable Mention Award

Presenter
Abubakar Zakari
Topic
Temperature Influence Gene Expression Pattern and Induced Lung Injury in Mice
Creator
Abubakar Zakari, Jer-Hwa Chang, Hsiao-Chi Chuang

Presenter
Thia Prahesti
Topic
Estimating the Spatiotemporal Variation of Total Hydrocarbon in Taiwan Using Spatial Prediction Model
Creator
Thia Prahesti, Aji Kusumaning Asri, Chih-Da Wu

Presenter
Yu-Ju Lin
Topic
基於地理人工智慧方法與微型感測器數據進行$PM_{2.5}$濃度未來時空預測
Creator
林祐如、許瑋倫、曾于庭、龍世俊、陳保中、紀凱獻、吳治達

Presenter
Liang-Han Qiu
Topic
使用機器學習方法納入影響性及相關性因子提升金屬氧化物VOC感測器數據的準確性
Creator
邱亮翰、黎氏菊、蔡春進

Presenter
Yen-Yu Ko
Topic
PFAS-containing SRF Combustion Test in a Traditional Incineration and GASMILD System
Creator
Yen-Yu Ko, Sheng-Lun Lin, Tzu-Yu Liao, Yu-Lun Hsieh, Jhong-Lin Wu

Student English Presentation Competition

First place

Presenter
Tzu-Chi Lin
Topic
Refining Ultrafine Particle Observations with De-weather and Explainable Machine Learning
Creator
Tzu-Chi Lin, Pei-Te Chiueh, Ta-Chih Hsiao

Second place

Presenter
Abubakar Zakari
Topic
Temperature Influence Gene Expression Pattern and Induced Lung Injury in Mice
Creator
Abubakar Zakari, Jer-Hwa Chang, Hsiao-Chi Chuang

Third place

Presenter
Li-Ti Chou
Topic
Optical Properties of Fresh and Photochemically Aged Dark Brown Carbon and Their Relationship with Oxidative Potential
Creator
Li-Ti Chou, Shu-Wen You, Prabhav Upadhyay, Zezhen Chen, Taveen S. Kapoor, Guodong Ren, Joseph V. Puthussery, Benjamin J. Sumlin, Rohan Mishra, Swarup China, Rajan K. Chakrabarty, Ta-Chih Hsiao

Student English Presentation Competition

Honorable Mention Award

Presenter
Thia Prahesti
Topic
Estimating the Spatiotemporal Variation of Total Hydrocarbon in Taiwan Using Spatial Prediction Model
Creator
Thia Prahesti, Aji Kusumaning Asri, Chih-Da Wu

Presenter
Yu-Cheng Lin
Topic
Evaluation of important factors and emission sources affecting the oxidative potential in fine particulate matter
Creator
Yu-Cheng Lin, Hsiu-Chuan Chou, Ta-Chih Hsiao, Yu-Cheng Chen

Presenter
Jia Lin Zhang
Topic
Enhancing indoor air quality and cardiopulmonary health in patients with asthma through photocatalytic oxidation and filters air purifier in a heavy industrial urban area
Creator
Jia Lin Zhang, Guan-Yu Liao, Hong-Yi Lin, Jie-An Xie, Wan-Chen Li, Pei-Shih Chen

Presenter
Kai-Jie Yang
Topic
The induced toxic effects of Caenorhabditits elegans induced by high $PM_{2.5}$ and high after intervention of Guilu Erxian Jiao
Creator
Kai-Jie Yang, Yi-Hong Lin, How-Ran Chao

Presenter
Li-Kuan Hsieh
Topic
Characteristic Study of Pollutant Removal in Electrostatic Precipitators Using DC and Pulsed High-Voltage Electricity
Creator
Li-Kuan Hsieh, Wen-Yinn Lin

Student English Presentation Competition

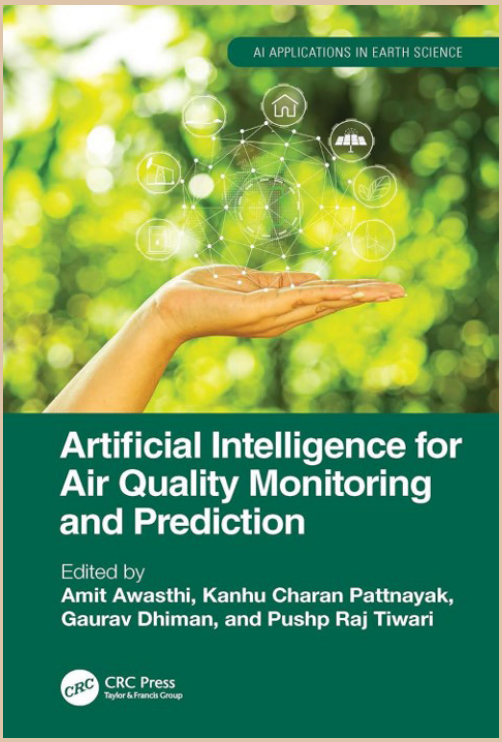
A photo with Ying-Yi Tsai, President of the Taiwan Association for Aerosol Research, and the winners of the Student English Presentation Competition

Poster Competition

A photo with Professor Sheng-Hsiang Wang and the winners of the Poster Competition

New Book on Aerosol

Artificial Intelligence for Air Quality Monitoring and Prediction (AI Applications in Earth Science)



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Publication date : October 2, 2024
Language : English
Print length : 301 pages
Page numbers source ISBN : 978-1032683799

by Amit Awasthi (Editor),
Kanhu Charan Pattnayak (Editor),
Gaurav Dhiman (Editor), Pushp Raj Tiwari (Editor)

This book is a comprehensive overview of advancements in artificial intelligence (AI) and how it can be applied in the field of air quality management. It explains the linkage between conventional approaches used in air quality monitoring and AI techniques such as data collection and preprocessing, deep learning, machine vision, natural language processing, and ensemble methods. The integration of climate models and AI enables readers to understand the relationship between air quality and climate change. Different case studies demonstrate the application of various air monitoring and prediction methodologies and their effectiveness in addressing real-world air quality challenges.

Features

- A thorough coverage of air quality monitoring and prediction techniques.
- In-depth evaluation of cutting-edge AI techniques such as machine learning and deep learning.
- Diverse global perspectives and approaches in air quality monitoring and prediction.
- Practical insights and real-world case studies from different monitoring and prediction techniques.
- Future directions and emerging trends in AI-driven air quality monitoring.

This is a great resource for professionals, researchers, and students interested in air quality management and control in the fields of environmental science and engineering, atmospheric science and meteorology, data science, and AI.

Introduction of Aerosol Researcher

Guan-Yu Lin

Current Position

Department of Environmental Science and Engineering, Tunghai University
Deputy professor

Qualification

Institute of Environmental Engineering, National Chiao Tung University
PhD

E-MAIL

samlin@mail.thu.edu.tw

Dr. Kuan-Yu Lin is currently a faculty member in the Department of Environmental Science and Engineering at Tunghai University. His research interests are diverse, encompassing the development of aerosol samplers, high-efficiency air pollution control devices, atmospheric physical and chemical properties, numerical simulation of mass transfer phenomena, and the environmental applications of machine/deep learning. In the past three years, his research topics have included: (1) enhancing data quality and calibration models for micro-sensors and establishing models for micro-environmental pollutant contributions; (2) developing prediction models for $PM_{2.5}$ and O_3; (3) experimental and simulation studies of nanoparticle dispersion and ventilation effects; (4) applying wet electrostatic precipitation technology for nanoparticle control in semiconductor processes; and (5) developing carbon capture and crystallization granulation technologies. Dr. Lin's future research aims to integrate numerical simulations and artificial intelligence technologies into the design and development of air pollution control and monitoring equipment, bridging theoretical science with practical applications.

Over his four years of teaching, Dr. Lin has published 15 SCI journal articles, including 10 as first or corresponding author, in leading journals such as Chemosphere, Environmental Pollution, Environmental Research, Atmospheric Environment, and Ecological Informatics.

Recent research topics

1. Development of data quality enhancement and calibration models for micro-sensors, and establishment of contribution models for micro-environmental pollutants

$PM_{2.5}$ has been identified by scientists as a significant contributor to premature mortality, cardiovascular diseases, and cancer. In urban areas, approximately 90% of the global population is exposed to $PM_{2.5}$ concentrations exceeding 10 μg/m³, necessitating urgent health risk and exposure assessments to inform effective air pollution control strategies. Low-cost air pollutant micro-sensors offer the potential for extensive deployment, thereby addressing the temporal and spatial limitations of regulatory monitoring and aiding in the development of hotspot identification and pollution source attribution systems. However, the data quality of these sensors requires further improvement, and the applicability of calibration methods needs to be rigorously established.

Dr. Lin has conducted field calibration of $PM_{2.5}$ sensors deployed by the Environmental Protection Agency and developed a machine learning-based calibration model. After calibration, Dr. Lin analyzed data from 30 micro-sensors in an industrial area, employing kriging methods to map the spatiotemporal distribution of $PM_{2.5}$ concentrations and investigate pollution hotspots and diurnal variation characteristics. The research team further developed a microenvironment pollutant contribution model using neural network algorithms. The findings have been published in Environmental Research. Dr. Lin and the research team will continue to study the contribution of VOC sources in microenvironments in future research.

Recent research topics

2. The establishment of forecasting models for $PM_{2.5}$ and O_3

To establish an air pollution early warning system, Dr. Lin utilized a deep learning approach, specifically the Nonlinear Autoregressive Neural Network with External Input (NARX), to develop forecasting models for $PM_{2.5}$ and O_3 time series concentrations. The input parameters for the model included concentrations of pollutants such as SO_2, NOx (NO + NO_2), CO, O_3, $PM_{2.5}$, and PM_{10}, as well as meteorological parameters like temperature (T), relative humidity (RH), wind direction (WD), wind speed (WS), and global radiation (GR). The data used for model development encompassed $PM_{2.5}$ and ozone concentration data from 2019 to 2021, while the model validation was conducted using 2022 data from monitoring stations.

This approach ensures that the model is validated with new data. The data were extracted from the two nearest ambient air quality monitoring (AQM) stations to the selected target station in this study. By incorporating spatiotemporal information from the two nearest AQM stations rather than using the entire dataset from all stations, the model avoids overfitting and computational limitations. The target values were the $PM_{2.5}$ and O_3 concentrations at the target station. Additionally, the primary advantage of this model is its ability to update predictions through the rolling adjustment manner, which enhances the accuracy of $PM_{2.5}$ and O_3 concentration predictions as the input parameters evolve over time.

Recent research topics

3. Experimental and simulation study on nanoparticle and VOCs emission and ventilation efficiency

Dr. Guan-Yu Lin investigated the effectiveness of three different types of exhaust hoods in controlling nanoparticle (NP) emissions and isopropanol (IPA) gas. The three types of exhaust hoods studied were Constant Air Volume (CAV), Variable Air Volume (VAV), and Air Curtain (AC) fume hoods. A key innovation of this study was the development of a measurement method for tracking gas experiments to assess the performance of the fume hoods. Experimental results indicated significant concentrations of NP and IPA leakage in the CAV and VAV hoods under conditions where the hood sash was fully opened and pollutants were released outward.

The leakage percentage (LEP) for NPs and IPA in the CAV hood was 4.16% and 8.24%, respectively, compared to 3.37% and 3.23% in the VAV hood. Moreover, the simulation results for IPA and NP leakage in the CAV hood closely matched the experimental data, with errors of 4.8% and 16.8%, respectively, validating the effectiveness of the numerical model. The dynamic CAV simulation also showed leakage concentrations consistent with experimental values, with an error of 7.98%. The CAV tracking experiments revealed similar LEPs for IPA, NPs, and SF6, suggesting that IPA could serve as a suitable alternative to SF6 or NPs in fume hood tracking experiments, especially when considering carbon emission reduction. The experimental methods and numerical models developed in this study can be applied to the design of energy-efficient fume hoods and to evaluate their efficiency in controlling air pollutants.

Recent research topics

4. Development of wet electrostatic precipitation technology for nanoparticle control in semiconductor processes

In recent years, Wet Electrostatic Precipitators (WEPs) have been introduced into advanced semiconductor facilities as on-site particle control devices, achieving a high collection efficiency of over 95%. However, WEPs are high-voltage electrical devices, which pose risks of electric shock and sparking. Given the flammable nature of exhaust gases from semiconductor processes, there is a potential risk of deflagration within WEPs.

In practical operation, the risks of electric shock, sparking, and deflagration are primary concerns in the event of system failure. In response to these risks, Dr. Lin collaborated with Distinguished Chair Professor Chun-Jin Tsai from the Institute of Environmental Engineering at National Yang Ming Chiao Tung University to conduct efficiency testing and deflagration risk analysis for WEPs. The study found that the maximum energy output from the new three-phase high-frequency power supply (Insulated Gate Bipolar Transistor, IGBT) in the on-site WEPs was significantly lower than the minimum ignition energy of the mixed gases in the on-site positions of Diffusion (DIFF) and Epitaxy (EPI) processes. Additionally, during the DIFF process, the concentration of flammable gases at the central WEP inlet was consistently below the Lower Explosion Limit (LEL). The findings of this study provide a basis for the future design and evaluation of WEPs in semiconductor facilities, aimed at mitigating potential deflagration risks.

Recent research topics

5. Development of carbon capture and crystallization granulation technology

In 2020, approximately 40.8% of Taiwan's electricity was generated by natural gas power plants, contributing to carbon emissions of around 49 million metric tons, which accounted for 18.0% of Taiwan's total annual carbon emissions of over 270 million metric tons.

By 2025, natural gas is expected to account for 50% of electricity generation, and by 2050, fossil-fuel-based power, combined with Carbon Capture, Utilization, and Storage (CCUS), will still represent 20-27% of total electricity production. The low concentrations of SO_2 and heavy metals in the exhaust from natural gas facilities make CO_2 capture more efficient and cost-effective, requiring no additional pollution treatment. However, while most CCUS research focuses on coal-fired plants, further studies are needed for natural gas applications.

Dr. Lin is advancing CO_2 capture using a high-efficiency, low-pressure-drop structured honeycomb scrubber tower, employing highly alkaline solutions like sodium hydroxide or calcium hydroxide, which produce no waste gases, odors, or ammonia nitrogen wastewater. The solution circulates within the tower until carbonate ions reach the desired concentration, after which it undergoes downstream processing through precipitation devices and fluidized bed crystallization systems to recover calcium carbonate as a byproduct. This byproduct will be further purified for industrial reuse. The three-year project aims to initially process 1 CMM of exhaust gas with 5% CO_2 content, capturing 71-142 kg of CO_2 per day, with a later phase targeting 10 CMM and capturing 710-1420 kg of CO_2 per day, followed by pilot plant experiments in the field.