



# PM<sub>2.5</sub> 及奈米微粒監測與控制技術聯盟



## 永續環境的綠色技術及 PM<sub>2.5</sub> 空氣過濾技術研討會

日期：108 年 07 月 11 日(四)

時間：13:30~16:30

地點：國立交通大學環境工程研究所環工館 1 樓演講廳(新竹市大學路 1001 號)

主辦單位：PM<sub>2.5</sub> 及奈米微粒監測與控制技術聯盟

協辦單位：台灣 PM<sub>2.5</sub> 監測與控制產業發展協會。

參加對象：PM<sub>2.5</sub> 及奈米微粒監測與控制技術聯盟會員廠商、台灣 PM<sub>2.5</sub> 監測與控制產業發展協會會員及會員廠商、受邀各縣市環保局人員、政府環保機關、廠商或有需求的業者。

費用：免費

報名方式：即日起至 7 月 1 日(一) 止，採線上報名。

報名連結：<https://forms.gle/4SbsFEjwvyF3DYk38>

聯絡窗口：任珮瑩 E-mail: [jessicajen@nctu.edu.tw](mailto:jessicajen@nctu.edu.tw) Tel:03-5712121 ext. 55536

### 活動時程表

時間	內容
13:10~13:30	報到
13:30~14:30	主講人: 裴有康 院士 Dr. David Y.H. Pui 題目: 永續環境的綠色技術 Green Technologies for Sustainable Environment
14:30~14:40	Break Time
14:40~15:40	主講人: 陳聖傑博士 Dr. Sheng-Chieh Chen 題目: 用於室內空氣清淨機和 HVAC 系統的帶電濾材微粒控制技術 Overview of charged filter media used in indoor air cleaner and HVAC system for fine particle control
15:40~16:20	綜合座談 Q&A
16:20~16:30	合照時間
16:30~	研討會結束



## Green Technologies for Sustainable Environment

### David Y.H. Pui, Ph.D

Distinguished McKnight University Professor, Director of the Center for Filtration Research (CFR)

### 2016 年美國國家工程學院院士 (National Academy of Engineering, NAE)

Professor David Y. H. Pui is a Distinguished McKnight University Professor and LM Fingerson/TSI Inc. Chair in Mechanical Engineering at the University of Minnesota. Dr. Pui is a Member of the U.S. National Academy of Engineering (NAE) and Director of the world-renowned Particle Technology Laboratory (PTL) at the University of Minnesota. He is also the Director of the Center for Filtration Research (CFR) with 21 leading international filtration companies as members. He has a broad range of research experience in aerosol and nanoparticle science and filtration technology and has 300 journal papers and 40 patents. He has developed several widely used commercial aerosol instruments and is a co-founder of Nanocopoeia for nano-formulation of pharmaceutical drugs. Dr. Pui has received many awards, including the Max Planck Research Award (1993), the Humboldt Research Award for Senior U.S. Scientists (2000), the Fuchs Memorial Award (2010) -- the highest disciplinary award conferred jointly by the American, German and Japanese Aerosol Associations, and the Einstein Professorship Award (2013) by the Chinese Academy of Sciences (CAS).



# PM<sub>2.5</sub> 及奈米微粒監測與控制技術聯盟



## Green Technologies for Sustainable Environment 永續環境的綠色技術

### Abstract

We are developing green technologies that benefit sustainable environment, which will enable people and the environment to prosper together. The Particle Technology Laboratory (PTL) has developed many instruments and samplers to perform atmospheric measurements, which helped to establish the U.S. PM<sub>2.5</sub> standard. The effects of PM<sub>2.5</sub> pollutants on the atmospheric visibility and human health will be addressed. The major PM<sub>2.5</sub> sources in China have been identified to come from coal burning, vehicle emissions and steel/cement plants. Filtration is the principal means to control PM<sub>2.5</sub> pollutants. The Center for Filtration Research (CFR) at the University of Minnesota, consisting of 21 leading international filtration companies, was established to find filtration solutions to mitigate PM<sub>2.5</sub> and other environmental pollutants. CFR investigators perform fundamental and applied research on air, gas and liquid filtration. Fundamental research in measuring and filtering sub-20 nm particles in liquid and in air will be presented. A Gasoline Particulate Filter (GPF) for Gasoline Direct Injection (GDI) engines has been developed to meet LEV3 and Euro 6 standard. A disruptive innovation, namely, the Solar-Assisted Large-Scale Cleaning System (SALSCS), is proposed to mitigate PM<sub>2.5</sub> pollutants in urban air. A second generation SALSCS can be used to reduce CO<sub>2</sub> in the atmosphere. An integrative approach, from collaboration among academia, government, and industries, can effectively manage and mitigate the PM<sub>2.5</sub> pollutants, particularly in China.

美國明尼蘇達大學微粒技術實驗室(PTL, Particle Technology Laboratory, University of Minnesota)正在發展綠色科技以達成循環經濟之目標，使人們與環境可以永續共榮。PTL開發了許多用於大氣的檢測儀器和採樣器，有助於建立美國 PM<sub>2.5</sub> 的標準，也解決了 PM<sub>2.5</sub> 污染物對大氣能見度和人類健康的影響。在中國，造成 PM<sub>2.5</sub> 的主要來源來自燃煤、汽車廢氣和鋼鐵/水泥廠，而過濾則是控制 PM<sub>2.5</sub> 污染物的主要方法。明尼蘇達大學的過濾研究中心(CFR, Center for Filtration Research)由 21 家領先國際的過濾公司所組成，旨在尋找減少 PM<sub>2.5</sub> 和其他環境污染物的過濾解決方案。CFR 的研究人員進行了許多空氣、氣體和液體的過濾基礎和應用研究，本演講將報告液體和空氣中小於 20 奈米顆粒的過濾研究成果。CFR 已經開發出可符合 LEV3 和 Euro 6 標準、且適用於汽油直噴 (GDI) 發動機的汽油微粒過濾器 (GPF)；已發展成功的太陽能輔助大型清潔系統 (SALSCS)，可降低都市空氣中的 PM<sub>2.5</sub> 污染物；第二代 SALSCS 則可減少大氣中的二氧化碳。我們可透過學術界、政府和行業之間的合作下，提出的整合方法以有效地管理和降低 PM<sub>2.5</sub> 污染物。



## Overview of Charged Filter Media Used in Indoor Air Cleaner and HVAC System for Fine Particle Control

### Shawn (S-C) Chen, Ph.D

Assistant Professor, Mechanical and Nuclear Engineering, Virginia Commonwealth University

## Overview of Charged Filter Media Used in Indoor Air Cleaner and HVAC System for Fine Particle Control

用於室內空氣清淨機和 HVAC 系統的帶電濾材微粒控制技術

### Abstract

PM<sub>2.5</sub> has become one of the most important mortality risk factors worldwide (Cohen *et al.*, 2017). Recent studies by Organisation for Economic Co-operation and Development (OECD) and other scientific organizations have showed that PM<sub>2.5</sub> and air pollution caused ~1 million premature deaths in China in 2010. This number made up about 15% of the total deaths in China in the same year. The premature deaths can increase to 3 million for both China and India in 2060 if the ambient air quality is not improved. Filters made from electret media with quasi-permanent electrical charges have been widely applied to mitigate PM<sub>2.5</sub>, which are much more efficient than traditional filters based on the same pressure drop (energy consumption). They are being widely used in respirators as the personal protection equipment and in heating, ventilating, and air-conditioning (HVAC) systems of residential, commercial, office, school and hospital buildings to provide a clean indoor air. However, there exists some limitations on the applications of electret filter, including its high penetration in the size range, <100 nm, having high deposition in alveoli and bronchioles of deeper lung, efficiency reduction during



## PM<sub>2.5</sub> 及奈米微粒監測與控制技術聯盟



the operation (aging or loading) due to the screening of fiber charges by deposited particles, and unclear effects of RH in aging process, etc. In this seminar, an introduction of filtration technique, discussion of aforementioned issues and solutions, and the future challenges of electret filtration will be addressed.

PM<sub>2.5</sub> 已成為全球最重要的死亡風險因素之一 (Cohen 等, 2017), 經濟合作與發展組織 (OECD) 和其他科學組織的最近研究指出, 2010 年 PM<sub>2.5</sub> 和空氣污染導致中國約 100 萬人口過早死亡, 這一數字約佔中國同年總死亡人數的 15%。如果環境空氣質量沒有獲得改善, 2060 年中國和印度的過早死亡人數將增加到 300 萬人。具有準永久電荷的靜電濾材已被廣泛應用於減輕 PM<sub>2.5</sub>, 且它比相同電壓 (能量消耗) 的傳統過濾器更為有效, 已被廣泛運用於個人呼吸系統防護設備以及住宅, 商業, 辦公室, 學校和醫院建築物的加熱, 通風和空調 (HVAC) 系統, 以提供乾淨的室內空氣。然而在操作期間 (老化或加載), 靜電濾材的應用存在一些限制, 包括在 <100nm 尺寸的微粒的穿透較高, 造成肺泡和細支氣管中的微粒沉積。此現象是因為纖維電荷被沉積微粒所遮蔽, 以及 RH 在老化過程中的不明原因所造成。本次演講將介紹過濾技術, 討論上述問題並提出解決方案, 並說明靜電濾材的未來挑戰。

## 交通資訊：



自行開車	台鐵	高鐵
<ol style="list-style-type: none"> <li>1. 國道 1 號新竹交流道下，往大學路方向(加油站旁)，入校位置為北大門。</li> <li>2. 國道 1 號新竹科學園區交流道，新安路右轉，入校位置為南大門。</li> </ol>	可搭至〔新竹站〕再轉 2 號公車或計程車至交通大學(北大門)，下車後步行約 5 分鐘。	搭至〔新竹站〕，至出口計程車招車站，前往交通大學(北大門)，下車後步行約 5 分鐘。