

# 大氣酸性超細粒子監測器 Atmospheric Acidic Ultrafine Particle Measuring Device

## 基於擴散沉積及石英晶體微天秤頻率變化的嶄新酸性粒子監測技術

A novel technology for measurement of acidic particles based on diffusion deposition and frequency changes of quartz crystal microbalance

專利申請編號：62/909,263 (US)

越來越多證據顯示，大氣酸性超細粒子(即直徑0.1微米或以下的酸性粒子) 危害人體健康。由缺乏可靠的測量工具，相關的研究難以量化酸性超細粒子的濃度，故無法評估其對健康的影響。

理大研究團隊研發出嶄新的大氣酸性超細粒子監測器。該裝置由擴散採樣器和附有晶振片的石英晶體微天秤組成，能精確測量酸性超細粒子的濃度。監測器能同時收集酸性和非酸性超細粒子，被收集的粒子會在擴散採樣器上沉積。然後，非酸性超細粒子會被除去，而酸性超細粒子則會與晶振片產生化學反應。石英晶體微天秤測量超細粒子的質量變化，從而精確地計算酸性超細粒子的質量濃度和數量濃度。



大氣酸性超細粒子監測器  
Atmospheric acidic ultrafine particles measuring device



晶振片  
Crystal oscillators

Evidence has accumulated suggesting that acidic ultrafine particles (AUFPs, particles with a diameter of less than 0.1  $\mu\text{m}$ ) may affect human health. However, related researches lack reliable instruments to quantify the concentration of AUFPs for further evaluation of their health effects.

Our novel acidic ultrafine particle measuring device features a diffusion sampler and a quartz crystal microbalance (QCM) detector with specially treated crystal oscillators. The device can precisely measure the concentration of AUFPs. When in operation, both acidic and non-acidic ultrafine particles are collected and deposited on the diffusion sampler. While the non-acidic ultrafine particles collected are removed, the AUFPs react with the crystal oscillators. The QCM then measures the change in mass and calculates the mass and number concentrations of AUFPs.

### Principal Investigator

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### 特色與優點

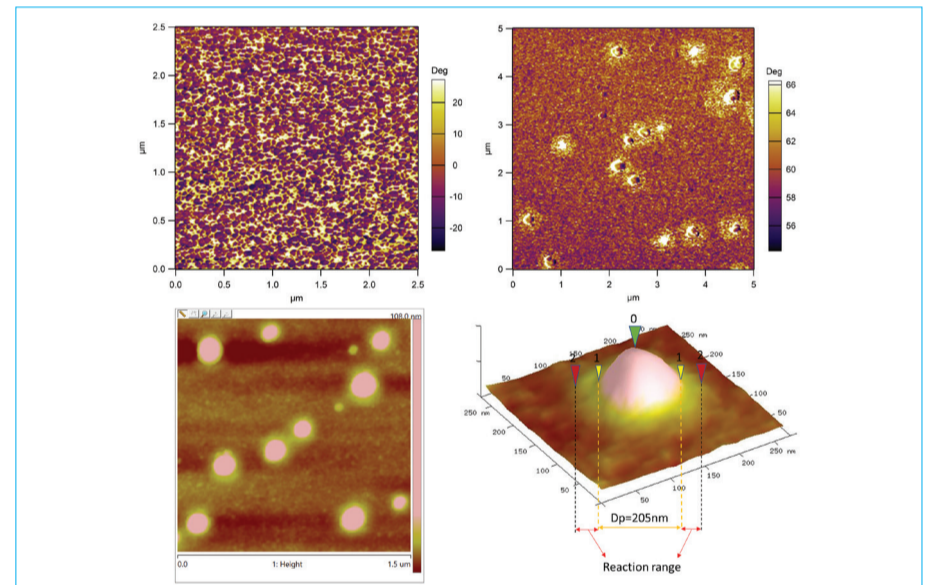
- 安全可靠
- 攜帶方便，操作容易
- 適用於戶內和戶外在線監測
- 提供大氣中酸性超細粒子濃度的可量化數據
- 生產及測量成本低

### 應用

- 空氣污染控制：評估各項改善空氣質素的措施
- 空氣污染研究：建立酸性/非酸性超細粒子及市區/分區主要污染示蹤氣體(如二氧化硫)的高質資料庫
- 流行病學研究：量化空氣污染對公眾健康的影響

### 獎項

- 第71屆德國紐倫堡國際發明展 - 金獎 (2019年11月)
- 泰國國家研究評議會特別獎 (2019年11月)



晶振片上的酸性超細粒子  
Acidic ultrafine particles on crystal oscillators

Patent Application No.: 62/909,263 (US)

### Special Features and Advantages

- Safe and reliable
- Portable and easy to operate
- Suitable for both indoor and outdoor online measurement
- Provides quantifiable data for assessing the concentration of acidic ultrafine particles in the atmosphere
- Involves low production and operation costs

### Applications

- Air pollution control: to assess various measures for improving air quality
- Air pollution study: to establish a high-quality database of acidic and non-acidic ultrafine particles, as well as major tracers (i.e. sulfur dioxide  $\text{SO}_2$ ) of urban and regional pollution
- Epidemiological study: to quantify the impact of air pollution on public health

### Awards

- Gold Medal – The 71st International Trade Fair “Ideas – Inventions – Novelties”, Nuremberg, Germany (Nov 2019)
- Special Merit Award from the National Research Council of Thailand (Nov 2019)



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