

計畫名稱：PH₃、AsH₃、CF₄、SiH₄、SF₆等13項污染物檢測方法之研究

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計畫執行單位：國防部中山科學研究院第四研究所

計畫主持人（包括協同主持人）：莊孝感

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摘要

吸取式FTIR檢測方法，為一現場操作直接取樣分析、不需任何前處理的檢測方法，可適用於半導體製造業排放管道及空氣中污染物之檢測。

本研究旨在建立排放管道及空氣中PH₃、AsH₃、CF₄、SiH₄、C₂F₆、CHF₃、NF₃、WF₆、SF₆、HCF₂CF₂CH₂OH、(CH₃)₂SO、(C₂H₅O)₄Si、SiCl₂H₂等13項污染物檢測方法。因SiCl₂H₂在大氣中極易水解，本研究建立其餘12種污染物之FTIR氣體標準定量圖譜及分析方法，並依據檢測標準方法驗證準則，完成吸取式FTIR檢測方法之檢量線、方法偵測極限、濃度適用範圍、精密度、準確度之測試與驗證。另以FTIR定性與定量分析法進行污染物混合氣體圖譜分析，及選定科學園區內二座排放管道及周界完成檢測方法驗證。最後依據測試與驗證結果完成檢測方法草案。

本研究建立之12項污染物吸取式FTIR氣體分析法之方法偵測極限(MDL)，皆低於此12項污染物之恕限值(TLV)，應可合乎民國八十八年一月六日頒佈「半導體製造業空氣污染管制及排放標準」之檢測需求。惟對工廠周界污染物檢測靈敏度需求，除PH₃與AsH₃外，其餘10種化合物之偵測極限均可滿足需求。

Extractive Fourier Transform Infrared (FTIR) Spectrometry is a directive sampling and analytical method in the field, without any sample pretreatment, suitable for the analysis of pollutants in atmosphere air and emission exhaust of the semiconductor manufacturing industry.

This study was aimed to establish the procedural and Quality Assurance and Quality Control (QA/QC) bases for gaseous concentration measurements of 13 pollutants, i.e., PH₃, AsH₃, CF₄, SiH₄, C₂F₆, CHF₃, NF₃, WF₆, SF₆, HCF₂CF₂CH₂OH, (CH₃)₂SO, (C₂H₅O)₄Si, and SiCl₂H₂, in emission exhaust and atmosphere air. Since SiCl₂H₂ is rapidly hydrolysed in the atmosphere air, the FTIR Gaseous Standard Quantitative Spectra and analytical methods of other 12 pollutants were developed in this study. This test methods have been tested and validated according to the "Principle of the Validation of Test Method", including the validations of calibration curve, method detection limit, concentration range, precision, and accuracy. We have employed an appropriate mathematical analysis to determine the preliminary analyte concentrations of mixed spectra. For field validation test, we have made measurements on the gases of two emission exhausts and the perimeter of the semiconductor manufacturing facilities in the Scientific Park. A protocol of this test method was accordingly proposed.

Since the method detection limits of these 12 pollutants are lower than the TLVs of these 12 pollutants, this extractive FTIR protocol can fulfil the detection requirement of the "Standard for Air Pollution Control and Emissions of Semiconductor Industry" issued January 6, 1999. For the detection requirement of pollutants on the perimeter of the

manufacturing facilities, except for PH₃ and AsH₃, the method detection limits of other 10 pollutants are within the limits required.

關閉視窗