

PIEZOBALANCE® Aerosol Monitor Literature References



The PIEZOBALANCE was sold by TSI Incorporated under three different model numbers including Models 3500, 5500 and 8510. The Model 3500 had a two-tone yellow/silver colored enclosure while both the Model 5500 and 8510 were solid black. All three models are functionally identical.



DESIGN, PERFORMANCE, & APPLICATION: PIEZOELECTRIC MICROBALANCE RESPIRABLE AEROSOL MASS MONITORS:

1. Olin JG, GJ Sem, & DL Christenson: Piezoelectric-Electrostatic Aerosol Mass Concentration Monitor. American Industrial Hygiene Assoc J 32(4):791-800 (1971).
2. Daley PS: The Use of Piezoelectric Crystals in the Determination of Particulate Mass. PhD Thesis, University of Florida, Gainesville, 189pp (1974).
3. Sem GJ, & K Tsurubayashi: A New Mass Sensor for Respirable Dust Measurement. American Industrial Hygiene Assoc J 36(11):791-800 (1975).
4. Daley PS, & DA Lundgren: The Performance of Piezoelectric Crystal Sensors Used to Determine Aerosol Mass Concentration. American Industrial Hygiene Assoc J 36:518-532 (1975).
5. Lundgren DA, LD Carter, & PS Daley: Aerosol Mass Measurement Using Piezoelectric Crystal Sensors. Fine Particles, Aerosol Generation, Measurement, Sampling, & Analysis, BYH Liu editor, pp486-510, Academic Press, NY (1976).
6. Sem GJ, K Tsurubayashi, & K Homma: Performance of the Piezoelectric Microbalance Respirable Aerosol Sensor. American Industrial Hygiene Assoc J 38(11):580-588 (1977).
7. Sem GJ: Respirable Ambient Aerosol Mass Concentration Measurement with a Battery-Powered Piezobalance. National Bureau of Standards Special Publication 464, pp191-197 (1977).
8. Sem GJ, & PS Daley: Performance Evaluation of a New Piezoelectric Aerosol Sensor. Aerosol Measurement, DA Lundgren et al editors, pp672-686, University Presses of Florida, Gainesville FL (1979).
9. Tsurubayashi K, & H Kano: Field Testing of Automatic Piezoelectric Microbalances for Outdoor Aerosol Mass Concentration Measurements. EPA-600/9-80-004, NTIS No PB 80-187 487, pp217-241, Proceedings: Advances in Particle Sampling & Measurement (Daytona Beach, FL, October 1979), WB Smith editor (1980).

10. Sem GJ, & FR Quant: Microcomputerized Continuous Piezoelectric Aerosol Mass Monitor. Proceedings: 9th Annual Meeting, pp280-285, Gesellschaft für Aerosolforschung, Schmallenberg, Federal Republic of Germany (1981).
11. Quant FR, PA Nelson, & GJ Sem: Experimental Measurements of Aerosol Concentrations in Offices. Environment International 8:223-227 (1982).
12. Tsurubayashi K, H Kano, & I Hayakawa: Mass Concentration Measurement by Piezoelectric Dust Meters. Aerosols in the Mining and Industrial Work Environments, Vol 3 Instrumentation, VA Marple & BYH Liu editors, pp1055-1075, Ann Arbor Sciences, Ann Arbor MI (1983).
13. Sem GJ, & FR Quant: Automatic Piezobalance Respirable Aerosol Mass Monitor for Unattended Real-Time Measurements. Aerosols in the Mining and Industrial Work Environments, Vol 3 Instrumentation, VA Marple & BYH Liu editors, pp1039-1054, Ann Arbor Sciences, Ann Arbor MI (1983).
14. Kim CS, D Trujillo & R McDonald: Response of a Quartz Crystal Aerosol Mass Monitor to Sulfate and Nitrate Aerosols. J Aerosol Sci 14(5):633-641 (1983).
15. Kim CS, MA Eldridge, & GA Lewars: Gaseous Interference to Performance of a Quartz Crystal Aerosol Mass Monitor. J Aerosol Sci 15(4):473-482 (1984).
16. Sem GJ, FR Quant, & GS Nordell: Continuous Particulate Mass Emissions Monitor for a Coal-Fired Steam Generator. Aerosols, BYH Liu, DYH Pui, & HJ Fissan editors, pp203-206, Elsevier Science Publ Co, NY (1984).
17. Lehtimäki M, & K Willeke: Measurement Methods, Aerosol Measurement, pp112-129, K Willeke & PA Baron, ed, Van Nostrand Reinhold, New York (1993).
18. Williams K, C Fairchild, & J Jaklevic, Dynamic Mass Measurement Techniques. Aerosol Measurement, pp296-312, K Willeke & PA Baron, ed, Van Nostrand Reinhold, New York (1993).
19. Baldwin DP, DS Zamzow, & AP D'Silva: Aerosol Mass Measurement and Solution Standard Additions for Quantitation in Laser Ablation-Inductively Coupled Plasma Atomic Emission Spectrometry, Anal Chem 66(11):1911-1917 (1994).

EXTENSIVE EVALUATION OF PIEZOELECTRIC AND BETA ATTENUATION RESPIRABLE AEROSOL MASS MONITORS:

20. Hersh SP, RE Fornes, & M Anaud: Short Term Cotton Dust Sampling Utilizing Three Non-Gravimetric Methods. American Industrial Hygiene Assoc J 40:578-587 (1979).
21. Fairchild CI, MI Tillery, & HJ Ettinger: An Evaluation of Fast Response Aerosol Mass Monitors. LA-8220, work supported by National Institute of Occupational Safety and Health and performed by Los Alamos Scientific Laboratory, PO Box 1663, Los Alamos NM 87545 USA, 71pp (1980).

22. Ogden TL: Direct-Reading Dust Instruments - A Selective Review. Report No IR/L/FD/80/28, Health and Safety Executive, Research and Laboratory Services Division, 403 Edgware Road, NW2 6LN, England (1980).
23. Tsai C-J, T-S Shih, & J-D Lin, Laboratory Testing of Three Direct Reading Dust Monitors. American Industrial Hygiene Assoc J 57(6):557-563 June (1996).

DESIGN & APPLICATION OF CASCADE IMPACTORS WITH PIEZOELECTRIC SENSORS:

24. Chuan RL, An Instrument for the Direct Measurement of Particulate Mass. J Aerosol Sci 1(2):111-114 May (1970)
25. Carpenter TE, & DL Brenchley: A Piezoelectric Cascade Impactor for Aerosol Monitoring. American Industrial Hygiene Assoc J 33:503-510 (1972).
26. Chuan RL: Application of an Oscillating Quartz Crystal to Measure the Mass of Suspended Particulate Matter. Analytical Methods Applied to Air Pollution Measurement, pp163-189, RK Stevens & WF Herget editors, Ann Arbor Science, Ann Arbor MI (1974).
27. Chuan RL: Rapid Measurement of Particulate Size Distribution in the Atmosphere. Fine Particles, Aerosol Generation, Measurement, Sampling and Analysis, BYH Liu editor, Academic Press, pp764-775 (1976).
28. Wallace D, & RL Chuan: A Cascade Impaction Instrument Using Quartz Crystal Microbalance Sensing Elements for "Real-Time" Particle Size Distribution Studies. National Bureau of Standards Special Publication 464, pp199-211 (1977).
29. Karasek FW: Cascade Particle Analyzer. Industrial Research/Development, pp 154-158, October (1978).
30. Woods DC & RL Chuan: Aerosol Characterization with a Quartz Crystal Microbalance Cascade Impactor. EPA-600/9-80-004, NTIS No PB 80-187487, Proceedings: Advances in Particle Sampling and Measurement (Daytona Beach, FL, October 1979), WB Smith editor, pp130-145 (1980).
31. Tsurubayashi K, & H Kano: Field Testing of Automatic Piezoelectric Microbalance for Outdoor Aerosol Mass Concentration Measurements. EPA-600/9-80-004, NTIS No PB 80-187487, Proceedings: Advances in Particle Sampling and Measurement (Daytona Beach, FL, October 1979), WB Smith editor, pp217-241 (1980).
32. O'Brien DP, P Baron, & K Willeke: Size and Concentration Measurement of Industrial Aerosol. American Industrial Hygiene Assoc J 47(7):386-392 (1986).
33. Horton KD, MHE Ball, & JP Mitchell: The Calibration of a California Measurements PC-2 Quartz Crystal Cascade Impactor (QCM). J Aerosol Sci 23(5):505-524 (1992).

34. Sharma VK, RS Patil: Size Distribution of Atmospheric Aerosols and their Source Identification using Factor Analysis in Bombay, India, Atmospheric Environment 26B(1):135-140 (1992).
35. Chuan RL: AGASP II Arctic Haze Aerosol Characteristics - Influence of Volcanic Eruption Emissions, Atmospheric Environment 27A(17/18):2901-2906 (1993).

USING PIEZOELECTRIC RESPIRABLE AEROSOL MASS MONITORS TO EVALUATE PERSONAL EXPOSURE TO RESPIRABLE SMOKE:

36. Repace JL, & AH Lowrey: Indoor Air Pollution, Tobacco Smoke, and Public Health. Science 208:464-472 2 May (1980).
37. Repace JL, WR Ott, & LA Wallace: Total Human Exposure to Air Pollution. Paper No 80-61.6, presented at the 73rd Annual Meeting of the Air Poll Cont Assoc, Montreal, Quebec, 22-27 June (1980).
38. Repace JL: Indoor Concentrations of Environmental Tobacco Smoke: Models Dealing with Effects of Ventilation and Room Size, Chapter 3, Environmental Carcinogens, Methods of Analysis and Exposure Measurement, Volume 9 - Passive Smoking, IK O'Neill, KD Brunnemann, B Dodet, & D Hoffmann, editors, pp25-41 (1987).
39. Repace JL: Indoor Concentrations of Environmental Tobacco Smoke: Field Surveys, Chapter 10, Environmental Carcinogens, Methods of Analysis and Exposure Measurement, Volume 9 - Passive Smoking, IK O'Neill, KD Brunnemann, B Dodet, & D Hoffmann, ed, 141-162 (1987).
40. Levy D: Scientific Unknowns Cloud Issue, USA Today, 7 July (1994).
41. Wallace L, Indoor Particles: A Review. J Air & Waste Manage Assoc 46(2):98-126 February (1996).
42. Ott W, P Switzer, & J Robinson, Particle Concentrations Inside a Tavern Before and After Prohibition of Smoking: Evaluating the Performance of an Indoor Air Quality Model. J Air & Waste Manage Assoc 46(12):1120-1134 December (1996).

PIEZOELECTRIC QUARTZ SENSORS IN SPIRAL AEROSOL CENTRIFUGES:

43. Stöber W, & FJ Mönig: Design and Performance of an Aerosol Mass Distribution Monitor. Proceedings: 4th International Clean Air Congress, III-15, pp406-410 (1978).
44. Stöber W, FJ Mönig, H Flachsbart, & N Schwarzer: Mass Distribution Measurements with an Aerosol Centrifuge with Quartz Sensors as Mass Detectors. J Aerosol Sci 10:194,232 (1980).

PIEZOELECTRIC QUARTZ CRYSTALS WITH ETCHED PORES, MAKING THEM FILTERS:

45. Holländer W, E Pape, M Plachky, P Vater, & R Brandt: Aerosol Mass Determination with Nuclear Track Filters from Quartz Crystals. J Aerosol Sci 17(5):859-871 (1986).

BOOK ON PIEZOELECTRIC MICROBALANCE TECHNOLOGY:

46. Ho MH: Application of Quartz Microbalances in Aerosol Mass Measurements. Application of Piezoelectric Quartz Crystal Microbalances, C Lu and AW Czanderna editors, Elsevier Science Publishers, NY pp351-388 (1984).

TSI Incorporated
500 Cardigan Road
Shoreview, MN 55126 USA



PiezoBalance_References.pdf
July 11, 2004