



PRODUCT INFORMATION

Model 140—Real-Time QCM-MOUDI™ Impactor

- A breakthrough in cascade impactor technology for size-fractionation and mass measurement of aerosols—MSP's MOUDI™ Impactor (Micro-Orifice Uniform Deposition Impactor) is now available with Quartz Crystal Microbalances (QCMs) for real-time mass measurement.
- Reliable mass sensing with nanogram resolution accomplished through sample humidity conditioning and advanced electronics.
- Samples are still available for post-collection chemical analysis.

**BACKGROUND**

Cascade impactors have been used for collecting and size fractionating aerosols for over a century. Significant advances were made in this technology in the late 1970s and the early 1980s by aerosol scientists at the University of Minnesota. In particular, collection of nanometer particles (<100 nm) was enabled and uniform deposit collection was introduced (Marple et al., 1991). This led to the Micro-Orifice Uniform Deposit Impactors (MOUDI) introduced as commercial products by MSP Corporation. These precision-grade cascade impactors are designed for sampling and collecting size-fractionated particle samples for gravimetric and/or chemical analyses. Several models of the MOUDI product line cover flow rates as high as 30 L/min and the cut-sizes between 10 nm and 10 μm .

The MOUDI impactor differs from other conventional cascade impactors in the use of a large number of micro-orifice nozzles to reduce jet velocity and pressure drop: minimizing particle bounce and re-entrainment, and enhance collection efficiency. Additionally, some models have the uniform-deposit feature which is achieved by rotating the impaction plate relative to the nozzles so that the particle deposits under the nozzles can be spread out uniformly over the entire impaction area.

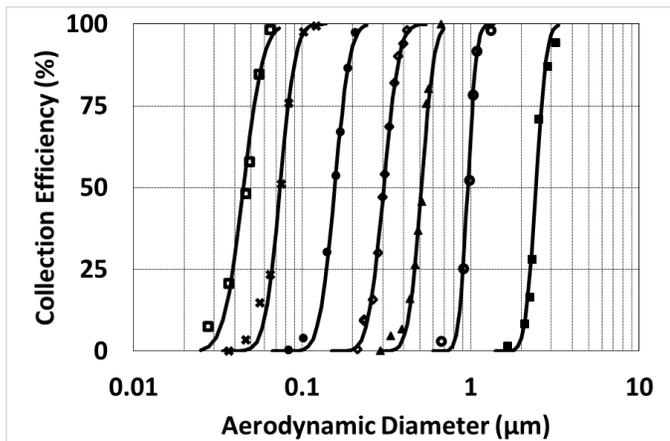
REAL-TIME QCM-MOUDI IMPACTOR

A Quartz Crystal Microbalance (QCM) is a sub-millimeter thick wafer cut out of a single crystal of quartz. Gold films deposited

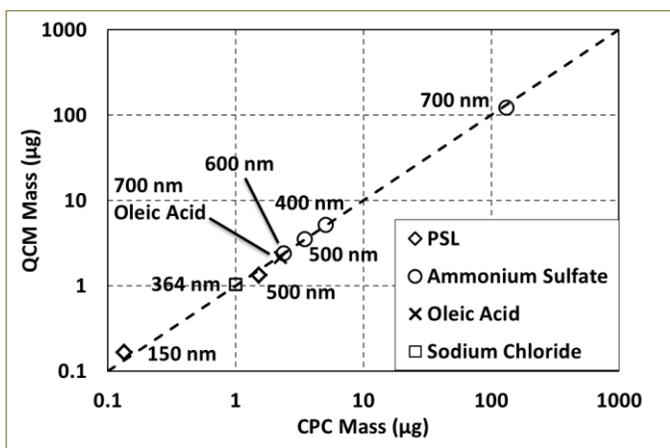
on both sides of the wafer serve as electrodes that are used to probe the natural frequency of vibration of the crystal. QCMs can be mounted to the impaction plates of cascade impactors, so the aerosol mass depositing on them results in a drop in the frequency that is proportional to the deposited mass. QCM surfaces can be easily cleaned after one or several measurements and reused.

Early attempts to utilize QCMs for real-time aerosol mass measurement were hampered by technological problems including the failure of the aerosol particles to remain firmly attached to the crystal surface. After meticulous investigation of the earlier anomalies in QCM response, MSP has developed a proprietary technology to reliably measure size-fractionated aerosol masses from tens of nanograms up to a few hundred micrograms. In particular, humidity conditioning of the aerosol sample ensures reliable coupling of aerosol particles to the QCM, and eliminates particle bounce.

A fully automated humidity conditioner ensures a final relative humidity of 55–65% regardless of the humidity of the incoming sample aerosol. The impactor has a 2.5 μm inlet and 6 QCM stages with well-defined, sharp collection efficiency curves with calibrated cutpoints of 960, 510, 305, 156, 74 and 45 nm at 10 L/min inlet flow rate. Particles collected on the QCM crystals can be easily cleaned or recovered for post-chemical analysis.



Stage collection efficiency curves measured experimentally with monodisperse aerosols.



Measurements of laboratory-generated aerosol on a single QCM stage: mass comparison with CPC.

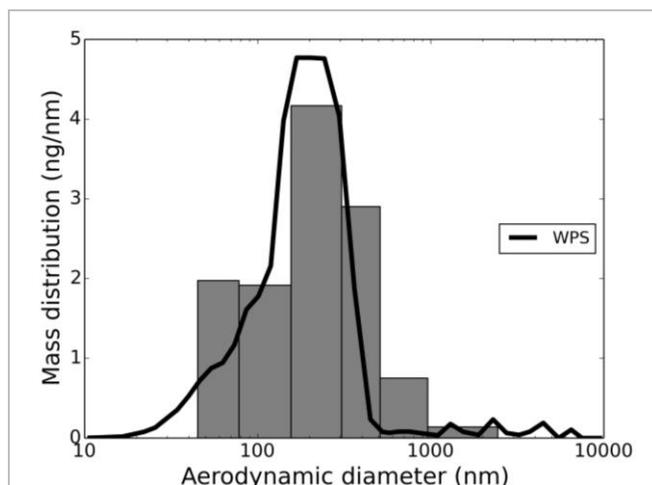
APPLICATIONS

- Sampling for air pollution and air quality research
- Inhalation toxicology testing
- Tobacco smoke testing
- Industrial hygiene studies
- Work place aerosol analysis
- Testing aerosol drug delivery devices

SPECIFICATIONS*

*Specifications are subject to change without notice

Sampling flow rate	10 L/min
Impactor Stages	6 (QCM) + PM2.5 inlet stage
Stage cut-sizes	45, 74, 156, 305, 510, 960, 2440 nm
Dimensions (DWH)	38 cm x 38 cm x 58 cm (15" x 15" x 23")
Weight	20.5 kg (45 lb.)
Power	115 VAC, 60 Hz or 230 VAC, 50 Hz
Operating Conditions	15–30°C, 0–100% RH (non-condensing)
Interface	Touch-screen color display (200 mm)



Measurement of ambient aerosol: comparison with Wide-range Particle Spectrometer (1000XP WPS).

TO ORDER

Specify	Description
140	Real-Time QCM-MOUDI Impactor, 6 Stage

REFERENCES

Marple, Virgil A., Kenneth L. Rubow, and Steven M. Behm. "A microorifice uniform deposit impactor (MOUDI): Description, calibration, and use." *Aerosol Science and Technology* **14.4** (1991): 434-446.

Chen, Modi, et al. "A novel quartz crystal cascade impactor for real-time aerosol mass distribution measurement." *Aerosol Science and Technology* **50.9** (2016): 971-983.

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