KANOMAX FMT
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Drift Tube Ion Mobility Spectrometer

Model 3006

The NEW Drift Tube Ion Mobility Spectrometer (DTIMS Model 3006) extends high-resolution ion mobility measurement to large molecules and nanoparticles. The ultrafast response is ideal for fast throughput of colloidal sample analysis in the gas phase, or measurement of dynamic aerosol systems such as nucleation or combustion processes.

- Particle measurement range from 2.0 to >40 nm
- High resolution (Zp/ΔZp) >20 up to 10 nm
- Ultrafast measurement (<10 sec) for sub-10 nm aerosols, 60 seconds for up to 40 nm
- Measurement data and operating status displayed on a color touch-screen panel

In atmospheric aerosol studies, electrical mobility separation has long been employed to classify particles for size distribution measurement. The resolution for devices using spatial separation is limited by the ratio of the aerosol flow to the separation gas (sheath) flow, and decreases with particle size due to diffusional broadening. The particle detection is typically a single-particle condensation particle counter (CPC). Traditional ion mobility spectrometers with ion detection measure molecules with high resolution independent of particle size, but in concentrations typically much higher than what is found in the atmosphere. The DTIMS employs the best of both approaches by combining the drift-tube's high mobility resolution with the sensitivity of a single-particle-counting detector. The DTIMS's innovative aspirating drift tube coupled with a fast-response CPC opens new measurement frontiers for rapidly measuring the size distribution of large molecules and nanoparticles.

Figure 1. Photo of the DTIMS

How It Works

The Drift Tube Ion Mobility Spectrometer (DTIMS) consists of two components: Model 3670 Drift Tube Ion Mobility Classifier (DTIMC) and Model 3650 Fast Condensation Particle Counter (FastCPC). Prior to analysis, the electric field is disabled allowing particles to fill a defined aerosol sample volume. At the beginning of the measurement, an axial electric field is applied causing charged particles within the sample volume to traverse the drift cell at a velocity proportional to their electrical mobility. The particle concentration at the exit of the drift region is measured by a fast-response CPC. The particle size distribution is then calculated from the time resolved particle concentration relative to the onset of the electric field.

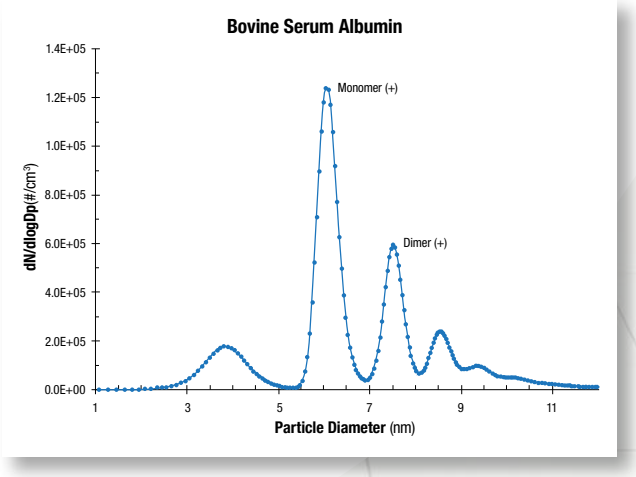

Figure 2. DTIMS ion mobility spectra.

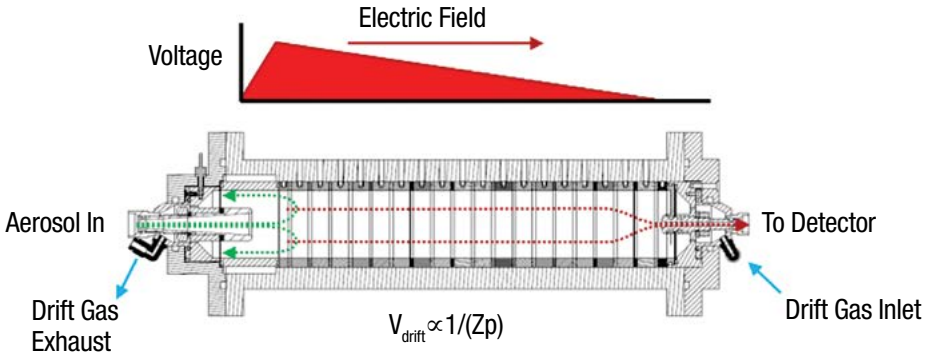

Figure 3. Schematic diagram of the DTIMC Model 3670 drift tube ion mobility classifier.

Specifications

DTIMS (Model 3006)

Sizing resolution	>20 Zp/ΔZp up to 10 nm, full width half maximum
Measurement time	<10 seconds for 1.8-20 nm, <60 s for <40 nm
Concentration range	1 to 100,000 particles/cm^3
Ambient temperature range	15 – 35°C (59 – 95°F)
Ambient relative humidity range	0 – 85% non-condensing

DTIMC (Model 3670)

Dimensions LWH in cm (inches)	21.5 × 23 × 40.5 (8.5 × 9 ×16)
Weight Kg (lbs)	20.2 (9.2)
Power	Universal 100 – 230 VAC 50/60 Hz, 75 W maximum
I/O	Ethernet communication, CPC pulse input
Display	7 inch color, touch screen

FastCPC (Model 3650)

Particle size detection	1.9 nm (Dp50) to >3 µm
Concentration range	1 to 100,000 particles/cm^3
Response time constant (τ)	~20 ms
Working fluid	n-butyl alcohol
Aerosol flow	300 cm^3/min
Inlet flow	600 or 1500 cm^3/min (user selectable)
Flow control	Critical orifice for sheath and transport flows, internal pumps
Dimensions LWH cm (inches)	21.6 × 19 × 21.6 (8.5 × 7.5 × 8.5)
Weight Kg (lbs)	6.8 (15)
Power	Universal 100 – 230 VAC 50/60 Hz, 75 W max.
I/O	RJ-45 with Ethernet, 9-pin D-subminiature connector with RS-232 serial communications, pulse output and user selectable analog output
Display	3.5 inch color, touch screen

Specifications subject to change without notice.

Bibliography

Derek R. Oberreit, Peter H. McMurry & Christopher J. Hogan Jr. (2014) Mobility Analysis of 2 nm to 11 nm Aerosol Particles with an Aspirating Drift Tube Ion Mobility Spectrometer, Aerosol Science and Technology, 48:1, 108-118, DOI:10.1080/02786826.2013.861893

Derek R. Oberreit, Peter H. McMurry & Christopher J. Hogan Jr. (2014) Analysis of heterogeneous uptake by nanoparticles via differential mobility analysis-drift tube ion mobility spectrometry, Physical Chemistry Chemical Physics, 2014 Apr 21;16(15):6968-79. DOI: 10.1039/c3cp54842b. Epub 2014 Mar 6.

Patent Information: U.S. Patent number 9207207 issued to the University of Minnesota and licensed by Kanomax FMT, Inc. Other patents are pending.

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