Bangs Laboratories, Inc.

January 9, 2007

NIST TRACEABLE PARTICLE SIZE STANDARDS

CERTIFICATE OF TRACEABILITY

This certifies that NIST Standard Reference Materials 1690, 1692 and 1961 were used to validate the accuracy and traceability of the calibration methods used to transfer the calibrated mean diameter dimension of this product.

Catalog Code: NT15N, Lot Number: 7895, Particle Size Standard
Certified Mean Diameter: 0.99μm
Uncertainty: ± 0.01μm
Date of Certificate: January 9, 2007
Date of Expiration: January 9, 2008

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Bangs Laboratories, Inc.

Void Without Seal

The most critical aspect of microparticle sizing is the use of microparticle size standards. National Institute of Standards and Technology (NIST) Traceable Particle Size Standards provide the accurate and traceable size calibration tools needed for particle size analysis. These standards are a series of particles with calibrated mean diameters from 40 nanometers (nm) to 175 micrometers (μm) traceable to NIST Standard Reference Material. It is the *mean diameter* which is certified and traceable to NIST, with further lot specific data provided for your information. These particles are supplied as an aqueous suspension in dropper-tipped bottles.

LOT SPECIFICITY

Catalog Code:	NT15N, Lot Number: 789
Certified Mean Diameter:	0.99μm ± 0.01μm
Standard Deviation:	0.0316μm
Coefficient of Variation:	3.2%
Microsphere Composition	Polystyrene
Polymer Density:	1.05g / 3
Index of Refraction:	1.59 @ 589nm
Approximate Concentrati	1% solids

1.875×6^b /ml

Because of the many different and acceptable sizing techniques used, it is important for the end user to know how we determine particle size. The certified mean diameter of 40nm to 9.0µm particle standards was obtained by Disc Centrifuge (DC), calibrated with NIST Standard Reference Materials (NSRM). This analyzer measures particle size distributions, using centrifugal sedimentation within an optically clear spinning disc. The principle involves the relationship between particle diameter size and the rate of sedimentation.

For 10µm to 175µm standards, the certified mean diameter was obtained by Single Particle Optical Sensing (SPOS), a combination of light extinction and light scattering. Individual particles pass through a small optical sensing region one at a time and produce a detecting pulse. The magnitude of the pulse depends on the size of the particle. The particle size distribution plot of the sample was constructed one particle at a time by comparing the detected pulse heights with a standard calibration curve based on NIST traceable particles of known diameters.

These methods allow statistically meaningful sampling with little user bias. The number of particles measured per sample is greater than 100,000. Repeated measures on the same sample give consistent results. Our measurement techniques are made with instruments calibrated and validated with NIST Standard Reference Material.

We employ manufacturing methods to reduce the impact of outlying peaks often found in 'monodisperse' standards, enabling us to produce calibration grade particle size standards with a narrower CV than many international standards.

Competitor Reported MD	Our Results
50 +- 2.0nm	49.4nm
269 +- 7.0nm	265.8nm
895 +- 8.0nm	889nm
2.013 +- 0.025µm	2.025µm
4.996 +- 0.035µm	4.9918µm
20.00 +- 0.10µm	20.10µm
49.8 +- 0.8µm	49.20µm
102 +- 1.4µm	102.1µm
160 +- 2.2µm	160.2µm

STORAGE AND HANDLING
Store upright at 4-8°C. Once screw cap has been removed, care should be taken to prevent contamination. Do not remove dropper tip. Do not freeze the particles.

PROCEDURE
Prior to dispensing your sample, gently invert the bottle several times followed by a 30 second low power ultrasonic bath.

EXPIRATION
This certificate is valid for one year from the date of shipment from Bangs Laboratories, Inc. provided the unit is stored as advised above. Bangs Laboratories' warranty is limited to replacement of defective products if returned with our authorization within 30 days of the purchase date.

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