

ZETASIZER NANO S/S90/Z/ZS/ZS90 SPECIFICATIONS MINIMUM TEMPERATURE 0°C

Introduction

For the Zetasizer Nano S, S90, Z, ZS or ZS90 instruments, the minimum temperature specification is 0°C . This technical note contains details of the experimental procedures and results obtained from measurements of a NIST traceable polystyrene latex as demonstration of this minimum temperature specification for the Zetasizer Nano range of instruments.

The specification of the temperature range is 0°C to 90°C, and the accuracy 0.1°C at 25°C, 0.2°C at 0°C and 0.5°C at 90°C. An extended high temperature option is available that extends the temperature range to 120°C with an accuracy of 1°C.

Measuring the absolute temperature of the sample in the cuvette accurately without affecting the measurement requires specialist equipment, so it is not possible for the laboratory scientist to check this parameter.

However, there is a way of checking that the temperature is stable over a range of values including zero degrees. This is by measuring a known size material, in this example a (nominally) 60nm latex standard in 10mM NaCl, at temperatures over which the sample is known to be stable, and observing that the results are repeatable.

Experimental

Materials

- 60nm polystyrene latex from the Thermo Scientific Duke Standards NIST traceable 3000 series (part number 3060A) supplied at a 1%w/v concentration
- 10mM NaCl
- Sizing cuvettes

Method

The polystyrene latex standard sample was prepared for measurement by adding 4 drops to 20ml of the 10mM NaCl solution.

A temperature trend measurement was used from 20° to 0°C at 5° intervals with a 120 second equilibration time at each temperature. Three repeat measurements were taken at each temperature.

For these tests where the sample is dilute, and the dispersant is water, the Zetasizer calculated the viscosity automatically from the temperature at the outside of the cuvette. This will be within 0.1°C of the set temperature.

Results

The results shown in figure 1 and summarised in table 1 demonstrate an automated trend plot, with three repeat measurements at 5 degree intervals from 20°C to 0°C. The individual temperature points show excellent repeatability, and all the results are within specification for the latex used. The trend line shows a change of 0.4nm over the temperature range. This is on average of $\pm 0.2\text{nm}$ over the range, which is equivalent to a variation in temperature of $\pm 0.1^\circ\text{C}$.

Figure 1: Temperature trend measurement of a Thermo Scientific 60nm Duke Standard showing the z-average diameters obtained from 3 repeat measurements at temperatures between 20 and 0°C

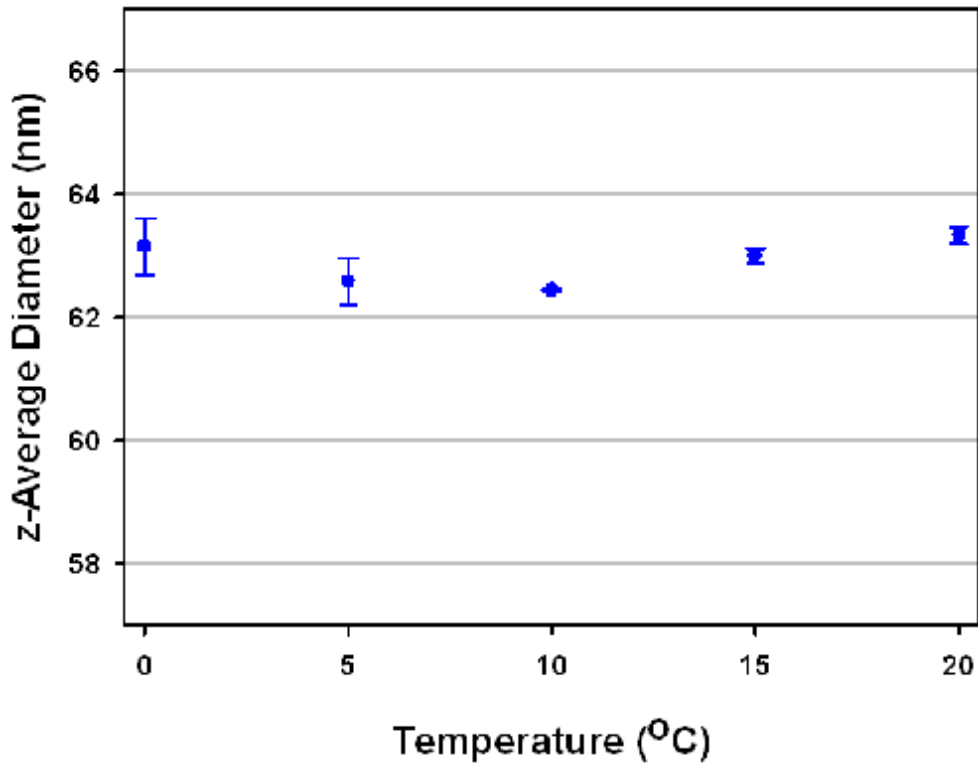


Table 1: Results obtained from temperature trend measurement of a Thermo Scientific 60nm Duke Standard showing the z-average diameters and polydispersity index values obtained from 3 repeat measurements at temperatures between 20 and 0°C

Temperature (°C)	Measurement	Z-Average Diameter (nm)	Polydispersity Index
20	1	63.5	0.002
2	63.3	0.017	
3	63.2	0.020	
Mean (S.D.)	63.3 (0.15)	0.013 (0.010)	
15	1	63.1	0.013
2	63.0	0.012	
3	62.9	0.040	
Mean (S.D.)	63.0 (0.12)	0.022 (0.016)	
10	1	62.4	0.023
2	62.5	0.010	
3	62.5	0.013	
Mean (S.D.)	62.5 (0.01)	0.015 (0.007)	
5	1	62.3	0.010
2	63.0	0.006	
3	62.5	0.020	
Mean (S.D.)	62.6 (0.38)	0.012 (0.007)	
0	1	63.2	0.048
2	62.7	0.004	
3	63.6	0.021	
Mean (S.D.)	63.2 (0.46)	0.024 (0.022)	

If the system was not capable of reaching the set temperature, the viscosity calculated by the Zetasizer or input manually for this temperature, would be the wrong value, and an incorrect size would have been calculated. At zero degrees, a temperature error of 1°C for example, would be equivalent to a size error of 3.2%, or 2nm for this sample.

In order to do measurements below the dew point, which is often at temperatures around 10°C in temperate climates, a supply of dry air to the inlet at the back of the Zetasizer is required to prevent condensation on the surface of the cuvette. Condensation must be avoided as it will affect the measurement results.

Conclusions

The results reported in this technical note confirm that the minimum temperature specification for the Zetasizer Nano S, S90, Z, ZS or ZS90 instruments is 0°C.

MALVERN PANALYTICAL

Groewood Road, Malvern
Worcestershire, WR14 1XZ
United Kingdom
Tel. +44 1684 892456
Fax. +44 1684 892789

Lelyweg 1,
7602 EA Almelo,
The Netherlands
Tel. +31 546 534 444
Fax. +31 546 534 598

info@malvernpanalytical.com
www.malvernpanalytical.com