

Engineered nanomaterial mechanisms of interactions
with living systems and the environment:
a universal framework for safe nanotechnology



NanoMILE Scientific Protocol

Characterisation of NMs by means of DLS

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1. Name(s) of scientific protocol:

Characterisation of NMs by means of DLS.

2. Scope and Domain:

Size and Zeta potential characterisation of project NMs by means of DLS.

3. Principle of the scientific protocol:

To determine the hydrodynamic size and zeta potential of the project NMs.

4. Description of scientific protocol:

NM dispersions were analysed as received or synthesised. In some cases dilution with ultrapure water was necessary. Powder NM samples were dispersed by means of specific NanoMILE dispersion protocols prior to analysis.

Size – A polystyrene cuvette was filled with about 1 cm of the NM dispersion to be analysed. This was then placed in the sample holder of the Malvern Zetasizer (nano ZS) with a laser of 633 nm and a scattering angle of 173°. A standard operating procedure was set up for each material and involved inputting the refractive index and absorption values of the material and the dispersant. A minimum of five consecutive measurements were collected to ensure repeatability and averaged to calculate a Z-Average size. The results were obtained at 20 °C with samples equilibrated for 2 minutes before measurements were started.

Zeta Potential – A zeta potential cuvette was injected with about 1 mL of the liquid to be analysed and was then placed in the sample holder of the Malvern Zetasizer (nano ZS). A standard operating procedure was once again set up for each material and involved inputting the refractive index and absorption values of the material and the dispersant. Once the parameters were set using the Zetasizer Software Version 7.10, the measurement was begun. A

minimum of three consecutive measurements were collected to ensure repeatability and averaged to calculate the Average Zeta Potential. The results were taken at 20 °C with samples equilibrated for 2 min before measurements were started. The results obtained for three repeat samples were averaged.

Material	Refractive Index	Absorbance
Cerium Oxide	1.822	0.900
Zinc Oxide	2.010	0.010
Copper Oxide	1.590	0.010
Iron Oxide	1.700	0.500
Silver	0.540	3.000
Titanium Dioxide	2.496	0.010

5. Environment:

Benchtop.

6. Biological and/or environmental models used:

N/A

7. Chemicals and reagents used:

N/A

8. Nanoparticles used:

All project NPs.

9. Apparatus and equipment used:

Malvern Zetasizer (nano ZS)

10. Health and Safety Precautions:

The protocol should follow Control Of Substances Hazardous to Health (COSHH) standards, and general health and safety precautions apply.

11. Data analysis and Reporting the Data:

Average size distribution graphs were plotted in Excel using the raw data obtained from the Zetasizer software.

Zeta potential graphs were taken directly for the Zetasizer software.

12. Abbreviations:

Control Of Substance Hazardous to Health – COSHH

Dynamic Light Scattering – DLS

13. Limitations:

N/A

14. Publications:

N/A

15. References:

MALVERN. 2013. *Zeta Potential – An Introduction in 30 minutes [Online]*. Available: <http://www3.nd.edu/~rroeder/ame60647/slides/zeta.pdf>.

MALVERN. 2016. *Dynamic Light Scattering: An Introduction in 30 minutes [Online]*. Available: <http://www.Malvern.com/en/support/resource-center/technical-notes/TN101104DynamicLightScatteringIntroduction.aspx>.