

# Zeta-potential measurement of MXene suspensions

## III

Date: 2021-09-17

Tags: Zeta 18/08/2021Synth Nanoplexus 400 2021

Created by: James Bird

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Goal : Use Zetasizer to measure zeta potential of  $\text{Ti}_3\text{C}_2$  MXene nanoparticles in aqueous suspension

Procedure :

### Sample preparation

- Sample preparation is detailed in [\[Experiment\] Dynamic Light Scattering \(DLS\) for nanoparticle size-distribution acquisition IV](#)
- Target concentration suspensions transferred to DTS1070 folded capillary cell with 1mL Luer syringe - cuvette exterior gently dried if necessary

### Zetasizer instrument operation

Standard Operating Procedure (SOP) settings (zeta measurement type) in Malvern Zetasizer NanoSeries Red Nano-ZS, using Zetasizer software program:

- Narrow band filter fitted
- Water dispersant ( $\eta = 0.8872$  cP,  $\text{RI} = 1.330$ , dielectric constant = 78.5)
- Smoluchowski Model for  $F(\eta a)$  calculation
- Use dispersant viscosity as sample viscosity
- Temperature = 25 °C with 120 s equilibration time
- DTS1070 folded capillary cell
- Automatic measurement duration
- Three measurements per sample
- Automatic attenuation and voltage selection
- Auto mode analysis model

Results :

Only for sample concentrations of  $\approx 1.9 \times 10^{-2}$  wt% could a suitable attenuator be found to take zeta-potential measurements. Some useful measurement outputs for

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the three most dilute suspensions, for which measurements were successful, are given in the table below. All shown measurements met the data quality criteria and quality factors  $\gg 1$  indicate very good signal. All zeta potentials are highlighted in green to indicate that the mean value suggests a stable suspension due to  $\approx -30$  mV.

Concentration / wt%	$\zeta$ potential / mV	$\zeta$ deviation / mV	Electrophoretic mobility ( $U_E$ ) / $\mu\text{mcm/Vs}$	$U_E$ deviation / $\mu\text{mcm/Vs}$	Quality factor	QF StdDev
$1.9 \times 10^{-2}$	-43.2	8.17	-3.384	0.6401	6.19	1.76
$9.4 \times 10^{-3}$	-42.7	7.69	-3.347	0.6031	5.63	0.495
$1.9 \times 10^{-3}$	-41.2	8.31	-3.234	0.6514	5.47	1.94

Raw datafile is found in simultaneous experiment (see [\[Experiment\] Dynamic Light Scattering \(DLS\) for nanoparticle size-distribution acquisition IV](#)) which can be read into the Zetasizer software program, .csv is an exported, comma-separated summary of the .dts datafile and .png is the plotted data; apparent zeta-potential is plotted against the total counts for that zeta-potential interval. Vertical lines spanning the whole plot height are mean zeta-potential values, where the regions of matching colour spanning left and right of this value correspond to its standard deviation.

### Conclusions:

Again, when comparing  $\zeta$ -potential against DLS measurement conditions it is apparent that this concentration range and sample type is better suited to  $\zeta$ -potential measurements than DLS measurements.

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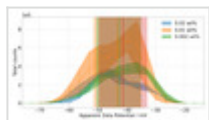
### Attached files

2021-09-17\_Zeta.csv

sha256: 98d2e19f772b31dca93964ad2d666baa785bf3922a76bcf8e2ed331480720dc5

Zeta\_2021-09-17.png

sha256: ea6a2334e1ceedf92818fdf9cc78dae1480dee98ac719905618176ffe7ca647



Unique eLabID: 20230313-bfd6a16a5fbf768dfd1b7f68f3ac11eeb5132e7a

Link: <https://frankel-elab.manchester.ac.uk/experiments.php?mode=view&id=93>