Zeta-potential measurement of MXene suspensions II

Date: 2021-05-05
Tags: *Synthesis Optimisation Zeta*
Created by: James Bird

Goal : Use Zetasizer to measure zeta potential of Ti_3**C_2 MXene nanoparticles in aqueous suspension**

Procedure :

Sample preparation

- Sample preparation is detailed in [Experiment] Dynamic Light Scattering (DLS) for nanoparticle size-distribution acquisiton III
- 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):

- Narrow band filter fitted
- Water dispersant (□ = 0.8872 cP, RI = 1.330, dielectric constant = 78.5)
- Smoluchowski Model for F(□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 :

Some useful measurement outputs are given in the table below. All shown measurements met the data quality criteria and quality factors >> 1 indicate very good signal, although samples from Runs 7 and 9 did not meet the criteria. All zeta potentials are highlighted in green to indicate that the mean value suggests a stable suspension due to   -30 mV. The red highlighted cell indicates that the deviation of the potential could indicate the suspension is not always stable. Run numbers highlighted in yellow are done so as they maybe considered stable within the stated uncertainties.

Run N° / #	potential / mV	deviation / mV	Electrophoretic mobility (U_E) / mcm/Vs	U_E deviation / mcm/Vs	Quality factor	QF StdDev
1	-32.8	3.82	-2.571	0.2993	9.09	0.688
2	-38.7	5.03	-3.037	0.3942	5.93	1.09
3	-34.9	3.69	-2.739	0.2894	5.88	0.878
4	-36.4	8.58	-2.858	0.6726	5.39	1.30
5	-26.6	3.74	-2.090	0.2935	5.58	1.76
6	-37.7	5.07	-2.952	0.3978	6.04	1.61
8	-43.6	8.57	-3.414	0.6720	4.29	1.00
10	-30.1	5.75	-2.357	0.4505	5.38	0.09
11	-8.56	4.74	-0.6707	0.3721	3.46	0.421
12	-35.2	4.65	-2.761	0.3644	6.4	2.22
14	-17.7	4.09	-1.391	0.3204	4.29	1.09
15	-25.6	4.18	-2.005	0.3277	7.01	1.39
16	-12.8	3.4	-1.002	0.2664	3.97	0.656

Raw datafile is found in simultaneous experiment (see [Experiment] Dynamic Light Scattering (DLS) for nanoparticle size-distribution acquisiton III) which can be read into the Zetasizer software program, .csv is an exported, comma-separated summary of the .dts datafile and .pngs are 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.

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Conclusions:

Again, when comparing ζ-potential against DLS measurement conditions it is apparent that this concentration range and sample type is better suited to ζ-potential measurements considering only two runs of fifteen failed to meet data quality criteria. Only five of the suspensions can be deemed stable, with another four on the border and four clearly unstable. These results indicate that suspension stability and polydispersity play a part in data quality criteria in DLS measurements not being met.

Attached files

2021-05-06_Zeta.csv
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Zeta_2021-05-06_SynthOpt_Run2.png
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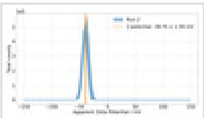

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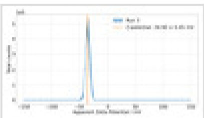

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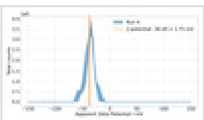

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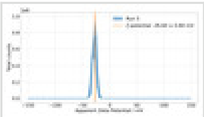

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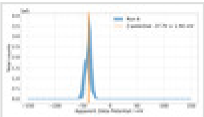

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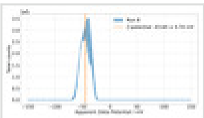

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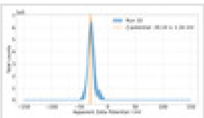

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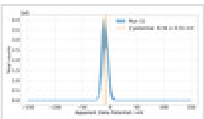

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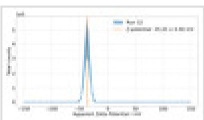

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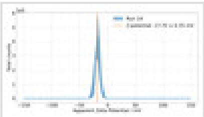

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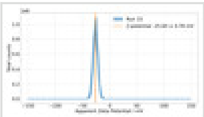

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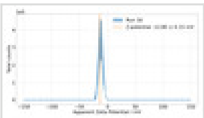

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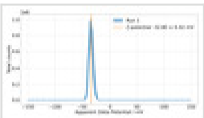

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