What are the sample concentration limits for a zeta potential measurement?

Chapter: Zeta Potential  
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During a zeta potential measurement, the scattered light from the sample is detected at a forward angle. Therefore, in general, samples for zeta potential measurements have to be optically clear to allow the beam to penetrate through. The minimum and maximum sample concentrations that can be measured will depend on the following factors:

- Optical properties of the particles
- Particle size
- Polydispersity of the particle size distribution

Minimum concentration requirement for zeta potential measurements.

The minimum count rate of scattered light required to make a measurement is 1kcps. However, if the count rate is this low, the measurement duration could be excessive as the signal to noise ratio will be very poor.

The minimum sample concentration required will depend upon the relative refractive index (the difference in refractive index properties of the particle and the medium) and the particle size. The larger the particle size, the more scattered light it produces and hence the lower the concentration that can be measured. For example, consider a dispersion of a ceramic powder such as titania which has a particle refractive index of around 2.5. This relative refractive index results in a very high level of scattering. Therefore, the minimum concentration of titania with a mean particle size of around 300nm that can be measured could be as low as $10^{-6}\%$ w/v.

If the relative refractive index becomes lower, such as with proteins for example, the minimum concentration will be much higher. A minimum concentration of between 0.1 and 1% w/v may be required to obtain sufficient scattering from a protein solution in order to make a successful zeta potential measurement.

Ultimately, the minimum concentration required for successful zeta potential measurements of a particular sample has to be determined experimentally.

Maximum concentration requirement for zeta potential measurements.

There is not a simple answer to the question what is the maximum concentration that can be measured during a zeta potential measurement in the Zetasizer Nano. The factors discussed above all have to be taken into account i.e. the particle size and polydispersity and the optical properties of the sample.
The scattered light from a sample in a zeta potential measurement is detected at a forward angle in the Zetasizer Nano. Therefore, the laser beam has to penetrate through the sample. If the concentration of the sample becomes too high, then the laser beam will become attenuated by the particles reducing the scattered light that is being detected. To try and compensate for these effects, the attenuator position in the instrument will be adjusted to a higher index i.e. a higher transmission.

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