TUNABLE RESISTIVE PULSE SENSING (TRPS)

IZON

www.izon.com

MEASURE BIOLOGICAL NANOPARTICLES WITH TUNABLE RESISTIVE PULSE SENSING

Tunable resistive pulse sensing (TRPS) is a precise measurement technique used to characterise the size, concentration and zeta potential of nano-sized particles. Whereas measurements from commonly used light scattering techniques can be skewed from the presence of large particles, the particle-by-particle nature of TRPS measurements enables you to characterise and compare samples with confidence.

HIGH-RESOLUTION SIZE ANALYSIS

- Measure the diameter of individual particles. Obtain number-based size distribution plots across a range of sizes from 40 nm to 11 µm.

SIMULTANEOUSLY MEASURE SIZE AND CONCENTRATION

- Obtain accurate particle concentration for a defined size range.

MEASURE THE ZETA POTENTIAL OF INDIVIDUAL PARTICLES

- Measure the zeta potential of each individual particle.

HOW DOES TRPS WORK?

TRPS works by applying the Coulter principle – a well-established method for counting and sizing particles – on the nanoscale.

In TRPS, nano-sized particles suspended in an electrolyte solution are characterised one-by-one as they pass through a nanopore that can be adjusted in real time.

Voltage is applied across a nanopore via silver/silver chloride electrodes, enabling a stable ionic current to be established. As each particle passes through the nanopore under the influence of voltage and pressure, the electrical current is disrupted momentarily. The drop in current is detected as a blockade signal.

Blockade signals are analysed to extract detailed information about particle characteristics:

- Blockade magnitude is directly proportional to the volume of each particle.
- Blockade frequency is used to determine particle concentration.
- Blockade duration changes with the velocity of the particle and is used to calculate zeta potential, a measure of the effective surface charge.

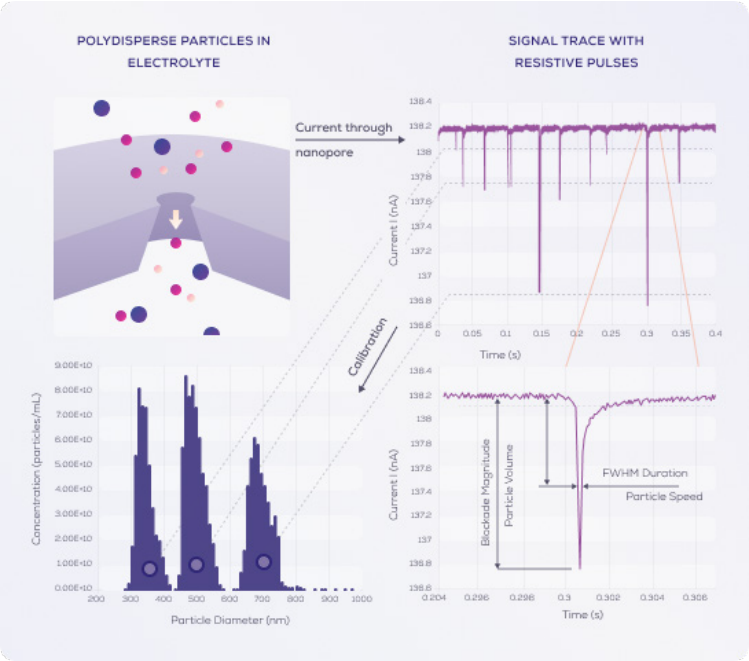


Figure 1: Key features of tunable resistive pulse sensing (TRPS). Top left: nanoparticles passing through a cross-section of a nanopore. Top right: signal trace with resulting blockades; each blockade corresponds to a single particle. Bottom left: size-based particle distribution plot; the high-resolution nature of TRPS enables subpopulations within a sample to be identified. Bottom right: components of a blockade used to derive particle size and surface charge. FWHM: full width half maximum.

CHARACTERISE INDIVIDUAL PARTICLES WITH CONFIDENCE

The Exoid, Izon's TRPS measurement platform, provides a true particle-by-particle approach to the physical characterisation of nano-sized particles.

High-resolution measurements are enabled by the single-nature particle nature of TRPS.

Excellent reproducibility and accuracy are ensured through the use of NIST-traceable calibration particles.

Determine particle diameter with high accuracy due to the linear relationship between particle volume and magnitude of the blockade signal.

While many other commonly used techniques are unable to resolve heterogenous samples, TRPS enables subpopulations in a sample to be resolved with a high level of resolution. Measurements are not skewed by the presence of larger particles, allowing you to compare your samples with confidence.

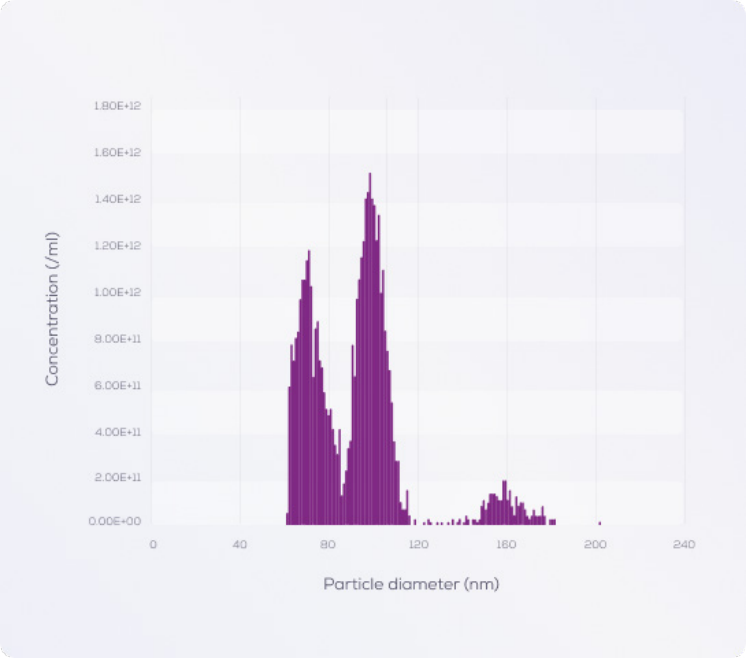


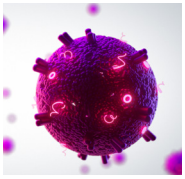
Figure 2: Size-based distribution of carboxylated polystyrene particles measured using the Exoid. The single-particle nature of TRPS measurements enables the three subpopulations in the sample to be resolved at a high level of resolution.

SIMULTANEOUSLY MEASURE SIZE AND CONCENTRATION

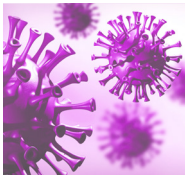
Using TRPS, you can measure particle size and concentration simultaneously. As blockade magnitude is directly proportional to particle volume, and blockade frequency can be used to determine particle concentration, TRPS provides precise insights on number-based distribution.

Such high-resolution insights of particle size and concentration are important capabilities for the characterisation of samples with heterogenous particle size distributions, including:

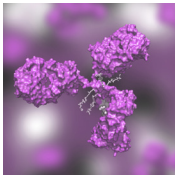
Extracellular vesicles



Virus-like particles



Monoclonal antibodies and other biopharmaceuticals



Lipid nanoparticles

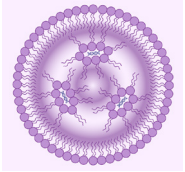


Figure 3: The Exoid Control Suite Software during a size and concentration measurement.

MEASURE THE ZETA POTENTIAL OF INDIVIDUAL PARTICLES

TRPS has the unique ability to measure particle size and zeta potential simultaneously, on a particle-by-particle basis.

Zeta potential is a measure of a particle's surface charge, and is often used as an indicator of colloidal stability. Defined as the electrical potential at the slipping plane of the interfacial double layer of a particle, zeta potential is useful for identifying biological analytes carrying different surface charge, when their sizes are comparable.

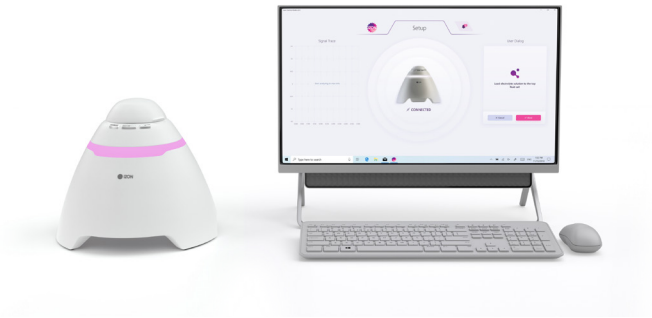
The single-particle approach of TRPS makes it much more precise than ensemble approaches, providing a powerful approach to charge analysis in the life sciences.

Figure 4: Zeta potential vs particle size of bare polystyrene particles (CPN100), carboxylated polystyrene particles (CPC70, CPC100), magnetic particles (Bio-Adembeads) and magnetic particles modified with DNA. The mix of five particle types closely resembles particle distribution when particle types are measured separately. Vogel et al. (2017). Sci Rep 7, 17479.

PRECISE NANOPARTICLE ANALYSIS USING THE EXOID

EXOID SPECIFICATIONS:

Analysis range	40 nm to 11 µm
Concentration range	1E5 to 1E11 / mL (size dependent)
Electrolyte properties	Physiological
Weight	10.8 kg
Footprint	300 x 300 mm
Height	250 mm



FOR MORE INFORMATION VISIT

www.izon.com