

SZP Surface Zeta Potential Measurement Quick Start Guide

Brookhaven Instruments NanoBrook • Particle Solutions Software
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Background

The Surface Zeta Potential (SZP) measurement determines the charge on a macroscopic surface, such as a membrane, film, or adhesive, on the Brookhaven Instruments NanoBrook. The sample is attached to a substrate held perpendicularly between two electrodes and immersed in a diluent containing probe particles of well-known charge.

Zeta potential is measured as the sample is moved progressively farther from the laser beam. As the surface moves toward an effectively infinite distance, it no longer influences the probe particles and the measured zeta potential plateaus to that of the original solution. Zeta potential is plotted against displacement and extrapolated back to the surface to obtain the surface zeta potential.

The Electrode

The surface of interest is attached to the substrate with an adhesive (glue or double-sided tape). The substrate mounts onto the movable arm of the electrode assembly and is secured with the screw. The assembly is then inserted into a cuvette containing the probe particle solution.

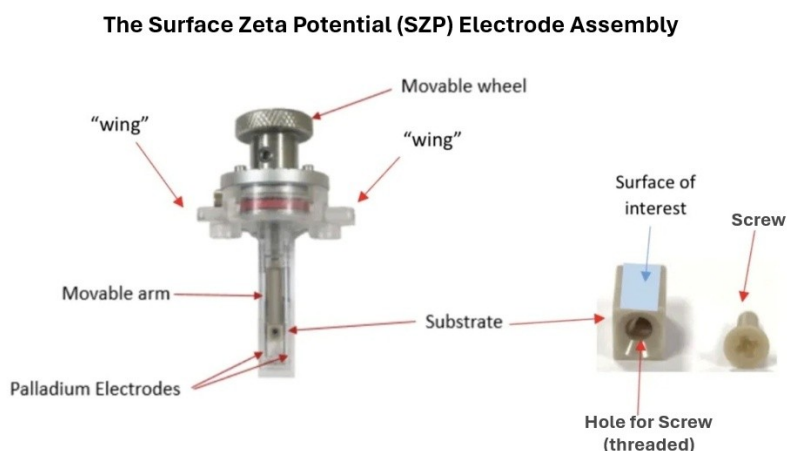


Figure 1. The SZP electrode assembly and substrate.

The movable wheel at the top of the assembly advances the arm in 20 micron increments, changing the position of the surface relative to the laser inside the NanoBrook instrument. The two palladium electrodes apply the field used for the PALS measurement, and the “wings” seat over the screws inside the instrument to lock the assembly in place.

Note

Always wear gloves when handling the substrate, sample, and electrode assembly to avoid contaminating the sample or the probe particle solution.

How to Choose a Probe Particle Solution

The charge on your surface is determined by monitoring the effect the surface has on a solution of known charge. As the surface is moved away, it has progressively less effect on that solution's behavior.

The ideal probe particle solution is highly stable (a high magnitude of charge) and matches the sign of your surface's charge. Pairing a positively charged surface with a negatively charged probe solution causes the particles to adhere to the surface, altering its inherent charge. For example, the ZR5 zeta potential reference material gives a charge of -44 ± 8 mV, making it well suited to negatively charged surfaces whose magnitude is less than that of the solution.

If the expected sign of your surface is unknown, begin with a simple solution such as ZR5. If the result is positive, measure a fresh sample using a positively charged probe particle solution instead.

Supplies

Required

- SZP electrode assembly (movable arm, palladium electrodes, movable wheel, and mounting screw)
- Substrate, 9.5 mm × 4 mm
- 4 mL square, four-sides-clear cuvette
- Probe particle solution of known charge (e.g., ZR5 zeta potential reference material)
- Adhesive: inert glue or double-sided tape
- Powder-free gloves

Preparing for Measurement

i. Adhering the Sample

1. Cut your surface to fit the 9.5 mm × 4 mm substrate without exceeding any edge.
2. If using glue, confirm it is inert and will not react with your sample or the probe particles. Apply a thin coat to the substrate, attach the sample, and allow the glue to dry.
3. If using double-sided tape, cut it to the size of the substrate, attach it, then press the sample onto the tape to adhere it.

Note

Wear gloves throughout the entire process to avoid contaminating your sample.

ii. Mounting and Filling

1. Mount the prepared substrate onto the movable arm of the assembly and secure it with the screw.
2. Fill a 4 mL square, four-sides-clear cuvette about halfway with your probe particle solution.
3. Confirm there are no bubbles between the electrodes or on the surface of your sample.
4. Insert the assembly into the NanoBrook, pressing the “wings” over the screws inside the instrument to seat it.

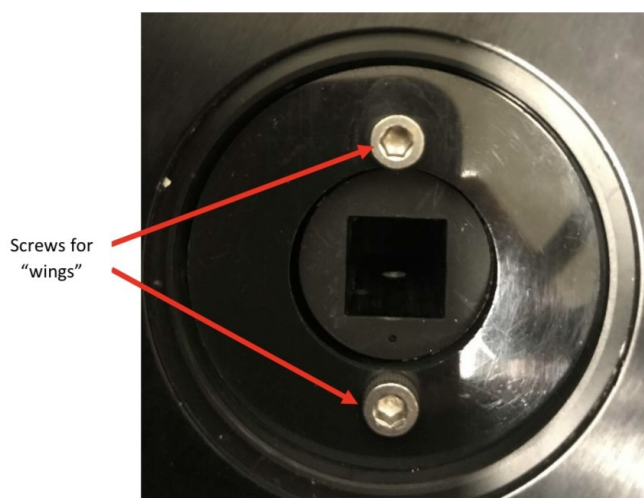


Figure 2. The instrument face. Seat the electrode “wings” over the two screws shown.

Running the Measurement

i. SOP Setup

With the sample loaded in the NanoBrook, open the Particle Solutions Software Suite. Select SZP Surface Zeta Potential measurement and click New to open the measurement window. Use the SOP editor to enter parameters relevant to your sample, including the Sample ID, preparation notes, probe particle solution information, and the number of PALS measurements to make at each displacement.

ii. Starting the Measurement

Click Start to begin. The software guides you through each step, prompting you to advance the sample with the movable wheel on the electrode assembly between displacements. Continue until all displacements prompted by the software have been measured.

Note

The movable wheel advances the arm in 20 micron increments. Move the sample only when prompted, and turn the wheel smoothly to avoid disturbing the solution between the electrodes.

Results, Surface Zeta Potential

Once all displacements are measured, the software plots zeta potential against displacement and extrapolates to the surface to report the surface zeta potential. Because the surface no longer influences the probe particles at large displacement, the curve plateaus to the zeta potential of the bulk solution; the extrapolated intercept is the value of interest.

For worked examples of sample preparation, software navigation, and data analysis, see the instructional videos at www.brookhaveninstruments.com.