

Application Note AN-T-235

# Determination of pH in carbon black

## Fast, accurate pH measurement in carbon black for battery cathodes according to ASTM D1512, ISO 787-9, and GB/T 1717

Conductive carbon black is an essential additive in modern lithium-ion batteries. It is used as an ingredient in the cathode and forms a conductive chemical structure that ensures that non-conductive materials (e.g., lithium nickel manganese cobalt oxides) are electrically connected to each other and to the current collector. Without conductive carbon black, no electrical current would flow, and the battery cell would not work. It is therefore essential to confirm the properties and quality of carbon black. In this respect, the pH value is among the first easy-to-check parameters.

However, in order to determine the correct pH value, both the method and the measuring equipment must meet the highest quality standards.

In this Application Note, the pH value in carbon black is accurately and reliably analyzed by using a 913 pH Meter equipped with a pH electrode according to ASTM D1512 as well as ISO 787-9 and GB/T 1717.

## SAMPLE AND SAMPLE PREPARATION

This application is demonstrated on carbon black used as a conductive additive cathode material.

Sample preparation is not required.

## EXPERIMENTAL

The pH values are carried out using a 913 pH Meter equipped with a pre-calibrated Unitrode easyClean (Figures 1 and 2).

To create the cathode slurry, an appropriate amount of sample is weighed into the sample beaker, and deionized water plus an organic solvent as wetting agent (according to the standards) are added. Afterwards, the cathode slurry pH is determined.




**Figure 1.** 913 pH Meter from Metrohm.



**Figure 2.** Unitrode easyClean with Pt1000 temperature sensor

## RESULTS

This method offers very accurate results, as shown in Tables 1 and 2.

**Table 1.** Results of the pH measurement of carbon black according to ASTM D1512 (n = 6).

| Sample (n = 6) | pH value | Temperature in °C |
|---|---|---|
| Mean | 8.62 | 24.3 |
| SD(abs) | 0.01 | 0.1 |
| SD(rel) in % | 0.1 | 0.2 |

**Table 2.** Results of the pH measurement of carbon black according to ISO 787-9 and GB/T 1717 (n = 6).

| Sample (n = 6) | pH value | Temperature in °C |
|---|---|---|
| Mean | 8.00 | 24.9 |
| SD(abs) | 0.02 | 0.1 |
| SD(rel) in % | 0.2 | 0.3 |

## CONCLUSION

The 913 pH Meter equipped with the Unitrode easyClean is an excellent combination to measure pH in cathode materials.
This setup is inexpensive, user-friendly, and takes up minimal bench space. Furthermore, as the name indicates, the easyClean diaphragm of the Unitrode can be easily cleaned even in the case of heavily contaminating samples like carbon black.

## CONTACT

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## CONFIGURATION



913 pH Meter, laboratory version

Portable two-channel pH measuring instrument for measuring pH/mV and temperature. You will be optimally equipped for measurements in the field and in the laboratory with this battery-operated measuring instrument with a stand plate.

- Portable pH meter with built-in battery pack and two galvanically isolated pH measuring inputs.
- Analog pH measuring input for Metrohm standard pH electrodes
- Digital pH measuring input for the intelligent pH electrodes from Metrohm
- Robust, water-tight, and dust-tight housing (IP67) for tough outdoor and laboratory use
- LCD color display with background illumination making results easy to read
- USB interface for simple data export to PC or printer
- Large internal memory (10,000 data sets)
- Pin-protected User mode and Expert mode, prevents unwanted parameter changes
- GLP-compliant printout and data export with User ID and timestamp