Application Note

THORNTON
Leading Pure Water Analytics

Sodium Measurement for Pure Water Treatment & Turbine Protection

Background

Sodium is one of the most common cations in water supplies and requires membrane separation, distillation or ion exchange for its removal. Even with ion exchange, it is the most loosely held cation and therefore the first to break through a cation exchange resin bed.

Monitoring sodium in makeup water treatment immediately after cation exchange provides the key parameter for initiating regeneration. Sensing the first sodium break through and stopping the run reduces the load on mixed bed ion exchangers downstream by lowering the frequency of their more expensive and more time-consuming mixed bed regenerations compared with single bed ion exchangers.

Makeup water quality after mixed bed deionization can be very sensitively monitored at sub-ppb sodium concentrations. Sodium is representative of ionic contamination in general so its confirmation at such low levels along with very low conductivity provides confidence in the pure water quality entering the steam/water cycle.

Sodium is responsible for various types of corrosion. Sodium hydroxide is more volatile than other sodium salts and can be assumed to be the dominant sodium species carried over in steam.

Corrosion mechanisms include caustic embrittlement and stress corrosion which are aggravated as caustic concentrates tremendously in the first condensate contacting low pressure turbine blades or in crevices of other components. Great effort is expended in monitoring proper boiler operation to assure minimal carryover of contaminants in the steam. Caustic gouging in boiler tubes is another area of concern.

Sodium is always present in cooling water so ppb-level sodium measurement is extremely sensitive in detecting small condenser leaks. This sensitivity exceeds that of cation conductivity by a significant margin. For example, 0.2 ppb of sodium (0.5 ppb as NaCl) would increase conductivity by only 0.001 µS/cm. Early detection of contamination allows time for planning corrective action before the condenser leaks enlarge and serious damage occurs.

METTLER TOLEDO

Application Note

Sodium measurement challenges

Accurate trace level sodium measurement requires a number of precautions in order to achieve consistent results. The measurement uses an ion-selective sodium electrode, reference electrode and sample conditioning to assure response only to sodium. Conditioning consists of raising the pH of the sample to prevent interference from hydrogen ion. The design must also keep the reference electrode downstream of the sodium electrode to prevent reference electrolyte from contaminating the sample before it is measured. A further challenge is that calibration at very low concentrations can be difficult because standards at that low level are quite vulnerable to contamination.

Solution

The design of the METTLER TOLEDO Thornton 2300Na Sodium Analyzer is based on extensive instrumentation experience and is optimized to handle these measurement challenges. The electrode is formulated for high selectivity to sodium ion and is complemented by the use of diisopropylamine reagent which has properties to support that selectivity. The 2300Na includes a pH measurement to ensure that proper reagent addition is actually achieved and alarms on low pH. For efficiency, the reference electrode serves both the sodium and the pH measurements.

For calibration, the 2300Na provides unattended automatic calibration. It uses a relatively high concentration standard solution that is easy to prepare and handle. The standard is automatically and consistently diluted to low concentrations for calibration near the range of measurement. Multiple additions of the standard accomplish the known-addition method that fully calibrates the analyzer.

The METTLER TOLEDO Thornton 2300Na is available in a fully enclosed cabinet for installations on the plant floor or in a more accessible enclosure for cleaner environments.

www.mt.com/pro
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