ProMinent®

FOCUS ON
EVAPORATIVE COOLING TOWERS

ONLINE CORROSION MONITORING

Corrosion in evaporative cooling towers

Chemical and physical conditions prevailing in evaporative cooling towers promote corrosion of metal surfaces. Due to the operating mode of these systems, inorganic deposits, e.g. calcium carbonate, as well as microbiological films form and act aggressively on the materials used. Thus, corrosion damage occurring has far-reaching consequences: increasing maintenance costs, reduced efficiency of heat exchangers, contamination of water circuits, interruption of operations or even shutdown of systems. As corrosion processes cannot be avoided completely, cooling water should additionally be treated with corrosion inhibitors, and also the state of the system should be monitored continuously. On the one hand, online corrosion monitoring enables the evaluation of the effectiveness of the corrosion inhibitor, and on the other hand, provides information on the actual state of the system and thus makes it possible to detect arising damages at an early stage.

Methods for corrosion monitoring

Coupon corrosion measurement is the most common method to monitor corrosion in evaporative cooling towers. Small plates of the materials used are exposed to the flow of cooling water and these so-called coupons of a known size, thickness and mass are removed, cleaned and weighed at regular intervals (typically every 30, 60 and 90 days). The calculated weight loss can be converted into an average rate of corrosion, stated in mpy (milli inches per year). However, coupon corrosion measurement only provides an average rate of corrosion over a certain measurement period, fluctuations over time remain undetected. In contrast, online methods like LPR corrosion measurement allow real-time analysis of corrosion processes in the system.

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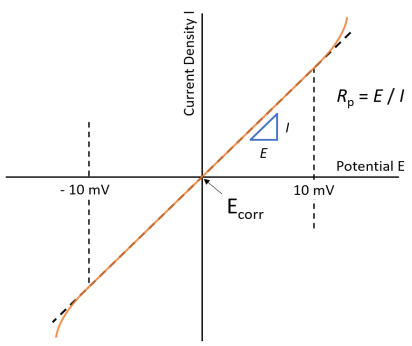
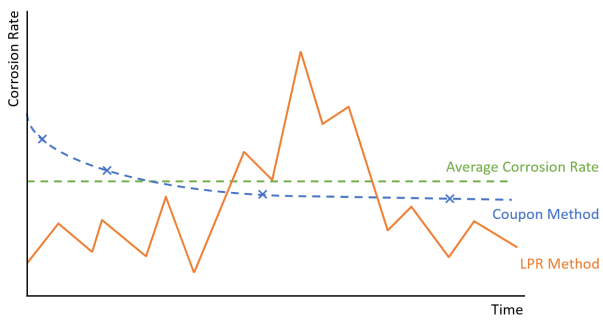
Online corrosion monitoring via LPR method

This method is based on measuring the Linear Polarisation Resistance (LPR). Online LPR sensors consist of two identical electrodes that immerse completely in the cooling water. These electrodes are made of the same material as used in the cooling system. By applying a DC voltage, the electrodes immersed in the electrolyte (cooling water) are polarised and generate a current flow I. The quotient E/I determines the polarisation resistance R_p. This physical variable shows linear behaviour within a certain potential range (material specific corrosion potential E_{corr} +/- 10 mV) and thus can be converted in a corrosion rate (stated in milli inches per year, mpy).





Corrosion rates calculated by the LPR method represent the current state of the system and thereby record short-term changes of process conditions that might cause corrosion damages (e.g. dosing of oxidizing biocides leads to an increased corrosion rate). Accordingly, these continuously measured corrosion rates fluctuate significantly depending on the conditions actually present in the system. In contrast, corrosion measurements via coupon method only identify single, punctual values at relatively long-time intervals. Nevertheless, both methods show comparable results when calculating an average corrosion rate over a certain measurement period. However, it is not possible to detect any potential causes of increased corrosion rates occurring over time. Corrosion rates monitored via LPR method document those moments when the system is exposed to increased corrosive conditions. That way, the cause of corrosive conditions can be identified, and subsequently, the process conditions and the cooling water treatment can be adapted.

Calculating the system specific time-resolved corrosion rate only requires an appropriate online sensor for Linear Polarisation Resistance measurement. These sensors can be easily integrated in the bypass of the cooling water circuit or in an already existing point of measurement. ProMinent offers sensors with electrodes made of the commonly used materials, like zinc, carbon steel, copper, stainless steel, brass and cupronickel. In combination with our controller for cooling water monitoring, AEGIS II, current corrosion rates within the system can be read directly and continuously. This easy to install, robust and long living measuring system makes it possible to detect corrosion damages at an early stage and to avoid extensive economic consequences.