Introduction
In flue gas desulfurization systems that use magnesium hydroxide (Mg(OH)$_2$) slurry, the consumption of the desulfurization agent (Mg(OH)$_2$) is controlled using online pH analyzers. A great concern in the pH measurement is heavy staining of the pH electrodes by the Mg(OH)$_2$ slurry. To ensure accurate measurement, frequent cleaning of the electrodes with an acid is required, adding to both maintenance workload and cost.

The EXA AUTO CLEAN chemical cleaning system automates the acid cleaning process, which not only saves both time and expense but also ensures precise pH measurement over long periods.

Expected Benefits
Improves the efficiency of a flue gas desulfurization system with Mg(OH)$_2$ slurry
Ensures stable, continuous pH measurement
Reduces operating costs
Eliminates manual cleaning

Process Overview
In the flue gas desulfurization system, Mg(OH)$_2$ is used as the absorbent to remove sulfur dioxide (SO$_2$) from the flue gas.

Absorption reaction 1:
Mg(OH)$_2$ + SO$_2$ -> MgSO$_3$ + H$_2$O

Absorption reaction 2:
MgSO$_3$ + SO$_2$ + H$_2$O -> Mg(HSO$_3$)$_2$

After absorbing SO$_2$, the solution undergoes pH adjustment, oxidation, and filtration for detoxification before discharge.

pH adjustment:
Mg(HSO$_3$)$_2$ + Mg(OH)$_2$ -> 2MgSO$_3$ + 2H$_2$O

Oxidation:
MgSO$_3$ + 1/2O$_2$ -> MgSO$_4$
Solution Details

Field Data
When performing pH measurement in a flue gas desulfurization system with Mg(OH)$_2$ slurry, the electrodes tend to become heavily stained by the slurry. The cleaning of the electrodes and the reduction of maintenance time and cost are key points to consider when selecting a pH analyzer for the system.

<table>
<thead>
<tr>
<th>Cleaning</th>
<th>pH System with Chemical Cleaning</th>
<th>General pH Analyzer</th>
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</thead>
<tbody>
<tr>
<td>“Automatic acid cleaning: 2 or 3 times/day, user programmable”</td>
<td>“Manual acid cleaning: once/day”</td>
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<table>
<thead>
<tr>
<th>Calibration</th>
<th>Automatic acid cleaning: once/day</th>
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<tr>
<th>Other maintenance</th>
<th>Replenishment of chemical tank: approx. every 2 months</th>
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Acid cleaning is done with a 4% hydrochloric acid solution

Product Recommendation

Measurement System

Process Liquid Analyzer:
- 2-wire FLEXA pH/ORP Analyzer

Features
Dual sensor measurement on 2-wire type analyser
Indication of sensor wellness
- 4-wire PH450G pH/ORP Analyzer

Features
Easy touchscreen operation
Trending display up to 2 weeks
Advanced Process Temperature Compensation

Sensor Selection:

Option #1: EXA AUTO CLEAN chemical cleaning system (Figure 3)

Sensors:
PH8EFP KCL Filling Type pH Sensor

Holders:
PH8HS3 Submersion Type

Operating System:
PH8SM3 Automatic Cleaning System

Notes:
An organic solvent cannot be used for cleaning.
Deterioration of material in chemical solution piping and air piping which the system is installed in a location where it is exposed to direct sunlight, the polyethylene resin piping will last approximately one year. (It is recommended that fluoro resin piping be used.)

Note: For additional information on this application contact the local Yokogawa Process Liquid Analyzer Department