Application Note

pH Measurement in Flue Gas Desulfurization Systems That Use Magnesium Hydroxide Slurry

Industry: Chemical, Power
Product: pH/ORP Process Liquid Analyzers

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:

$$Mg(OH)_2 + SO_2 \rightarrow MgSO_3 + H_2O$$

Absorption reaction 2:

$$MgSO_3 + SO_2 + H_2O \rightarrow Mg(HSO_3)_2$$

After absorbing SO_2, the solution undergoes pH adjustment, oxidation, and filtration for detoxification before discharge.

pH adjustment:

$$Mg(HSO_3)_2 + Mg(OH)_2 \rightarrow 2MgSO_3 + 2H_2O$$

Oxidation:

$$MgSO_3 + 1/2O_2 \rightarrow MgSO_4$$

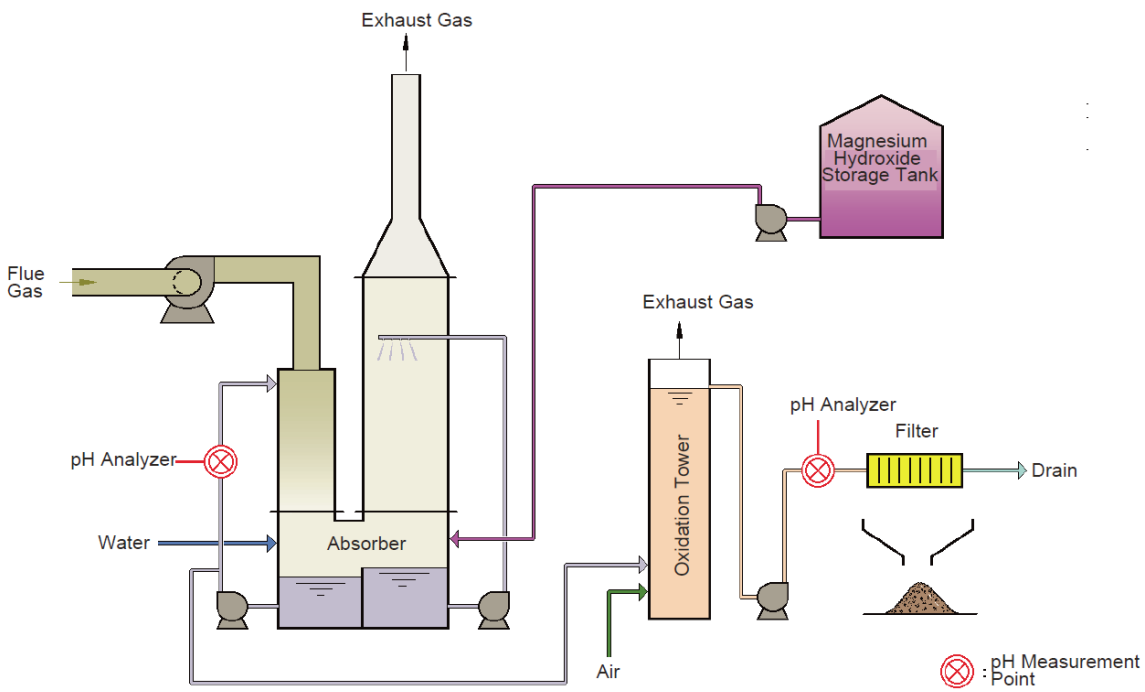

Figure 1.

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.

	pH System with Chemical Cleaning	General pH Analyzer
Cleaning	"Automatic acid cleaning: 2 or 3 times/day, user programmable Manual acid cleaning: approx.. monthly"	"Manual acid cleaning: once/day"
Calibration	Manual calibration: weekly	"Manual 2-point calibration: weekly"
Other maintenance	Replenishment of chemical tank: approx. every 2 months	-

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

Option #2: *Extract AUTO CLEAN system (Figure 2)*

Sensors:
SC25V 12mm all-in-one CIP/SIP pH
Holders:
RF20H Pneumatic Retractable
Operating System:
RF20C Automatic Cleaning System

Figure 2.

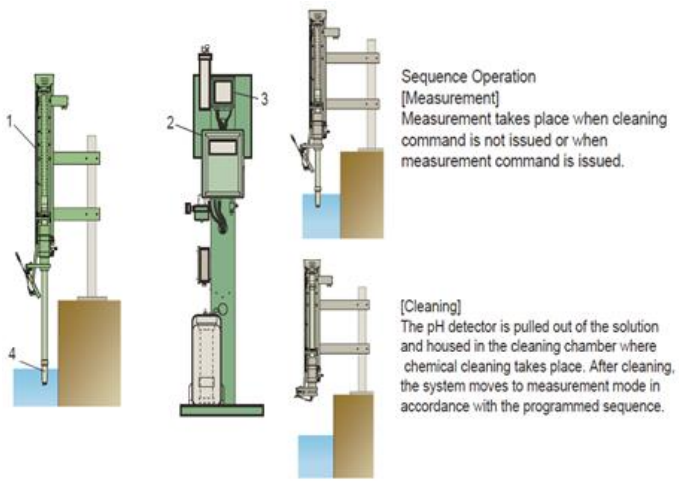

Figure 3.