

APPLICATION REPORT Power Generation

Flow and density measurement of lime slurry in flue gas cleaning

- Effective use of lime in desulphurisation units of a USC power plant
- Monitoring concentration and flow rate of a very abrasive and clogging medium
- Cost-efficient alternative to radiometric density measurement in feed lines to an absorption tower



1. Background

The energy company KOEN Co. Ltd. operates the state-of-the-art units 5 & 6 of a hard coal-fired ultra-supercritical steam (USC) power station in Incheon, South Korea. The units have an electrical output of 870 MW each.

In order to comply with strict environmental regulations on emissions of sulphur dioxide and trioxide (SO_2 and SO_3), the power plant units are equipped with flue-gas desulphurisation (FGD) units for flue gas cleaning.

2. Measurement requirements

The FGD units use the limestone/gypsum wet scrubbing process. This involves lime slurry prepared in an agitated reactor that is pumped to the top of the absorption tower, where it is sprayed into the rising flue gas by nozzles. As a result, SO_x in the flue gas stream is washed out (absorbed). Subsequently, a suspension of gypsum as a reacting by-product as well as unconverted lime slurry settles on the bottom of the tower. Both products are separated by a hydrocyclone. While gypsum is subsequently removed and collected, residual lime slurry is recirculated.

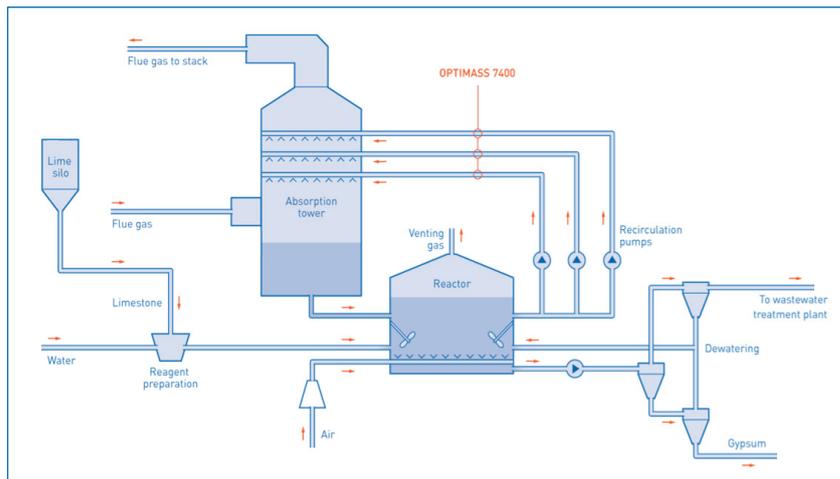
The concentration and flow of the lime slurry needs to be controlled for an effective use of the lime and a good flue gas cleaning result. Measuring lime is challenging as the medium is very adhesive and extremely abrasive. In the past, radiometric density gauges had been used for online density measurement of lime slurry to calculate lime concentration. However, given their implications in terms of maintenance and safety as well as environmental regulations, these devices turned out to be very expensive to operate. Therefore, the energy company was searching for an alternative non-radiometric process instrumentation that was also required to be non-susceptible to clogging and drifting.

KROHNE

3. KROHNE solution

The company decided on testing Coriolis mass flowmeters of different manufacturers to check the density measurement performance. Due to the test results KOEN selected the OPTIMASS 7400 F Coriolis mass flowmeter. 10 units of the KROHNE device have been installed to control the process within the FGD plant. All Coriolis meters are provided with a special wear protection and equipped with a remote field-mounted converter.

The OPTIMASS 7400 device has a single straight tube design and is particularly suitable for aggressive and sticky media like lime slurry. It reliably measures the flow rate, density and temperature in one device. In this way and by using specific algorithms the device can also output the lime concentration in the slurry. To guarantee the best possible density measurement, a sensor tube made from titanium was selected. The measured values are provided in the operators control room.



General scheme of FGD process



Lime slurry measurement with the OPTIMASS 7400 F

4. Customer benefits

The OPTIMASS 7400 ensures that always the desired amount and concentration of lime slurry in proportion to the SO_x content is sprayed into the flue gas stream. In this way, the operator can run the desulphurisation process as efficient as possible and with the best product yield in mind.

Using a standard Coriolis mass flowmeter without any nuclear source material, the energy company stands to gain from reduced capital and operating costs as well as reduced environmental impact.

There are no disposal costs for nuclear waste, documentation and administrative controls. Wipe tests and ongoing training of on-site radiation safety officers to perform calibration are not needed.

Due to the rugged design and abrasion resistance of the OPTIMASS 7400, the customer benefits from reduced wear and an extended meter lifetime. Higher measuring availability is ensured. Featuring only a single straight tube, the flowmeter is self-draining. There are also no issues with pressure loss, clogging or drifting. This guarantees low maintenance costs with low spare parts consumption and long maintenance intervals.

5. Product used

OPTIMASS 7400 F

- Coriolis mass flowmeter for advanced process applications
- High accuracy mass, density and volume flow measurement of viscous, aggressive or shear-sensitive media
- Flange: DN10...100 / 1/2...4", max. PN100 / ASME Cl 600; others
- Available in four sensor materials: titanium, stainless steel, Hastelloy® or tantalum



Contact

Would you like further information about these or other applications?

Do you require technical advice for your application?

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