

Monitoring sulphuric acid concentration

Fig 1: Sonic velocity, conductivity and density vs acid conc.

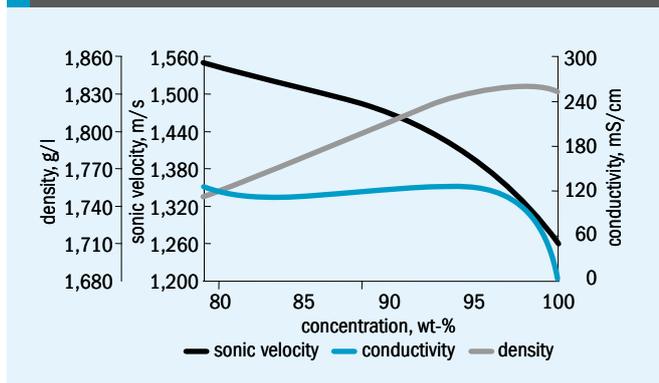


Fig 2: The LiquiSonic® analyser



Advanced ultrasonic sensing technology provider SensoTech has been focused on the development of in-line analysis systems for process liquids for more than 25 years. In sulphuric acid applications, the monitoring of sulphuric acid and oleum concentration (wt-%) on-line and in real time enhances the safety and efficiency of the plants. Manual sampling is time-consuming and may involve safety hazards. Laboratory analyses can only provide delayed data, making timely intervention in the process impossible. By contrast, methods using in-line measurements allow sulphuric acid concentration to be monitored directly in the process and in real time, enabling continuous measurements and providing on-line data.

Due to the physical properties of sulphuric acid, the most suitable method for determining the acid concentration is sonic velocity measurement. Fig. 1 shows the dependence of sonic velocity, conductivity and density on acid concentration (wt-%). As shown in the graph, conductivity probes do not provide a clear signal between 80 wt-% and 95 wt-% and density meters do not provide a clear signal between 95 wt-% and 100 wt-%, whereas sonic velocity provides a clear signal across both ranges.

In the chemical, petrochemical and mining industries, the relevant acid concentrations in production processes are typically in the range 70 wt-% to 100 wt-% sulphuric acid and 20 wt-% to 35 wt-% or

50 wt-% to 60 wt-% oleum. SensoTech's LiquiSonic® analyser (Fig. 2) is based on sonic velocity measurement and provides clear and high-precision data on the acid concentration in these ranges using only one single sensor.

In pickling and etching baths in the metallurgical and chemical sector, acid concentrations typically range between 0 wt-% and 30 wt-%. The LiquiSonic® sensor can also be used to provide reliable measurements of acid concentration in this range. For acid bath monitoring, sonic velocity is combined with a second physical value to determine the salt concentration as well.

On-line monitoring can also be used to improve process efficiency and reduce sulphuric acid consumption. For example, in refinery alkylation units sonic velocity meters reduce the amount of the spent acid and provide efficient control of the rate of fresh acid addition.

The LiquiSonic® analyser is successfully employed in plants worldwide to determine the sulphuric acid and oleum concentration. The sensor is installed directly in the existing pipe or vessel and provides stable measurements updated every second with an accuracy of up to 0.03 wt-%. For process automation, the real-time data can be transferred to process control systems via 4-20 mA signal, digital outputs, serial interface, fieldbus or Ethernet.

Made of Hastelloy C-2000, the sensor is fully corrosion resistant. The robust

construction requires neither gaskets nor moving parts, so the sensor is maintenance-free with long-term stability. The LiquiSonic® measuring method is based on a travel time measurement, sending a sonic signal from one side to the other of the sensor. Because the distance between the transmitter and receiver is known and constant, the sonic velocity can be determined using the data of path and time. The acid concentration and sonic velocity in the acid form a clear, functional relationship. Since sonic velocity also depends on the temperature, the LiquiSonic® sensor includes a high-precision temperature measurement. From the sonic velocity and temperature data, temperature-compensated and repeatable calculations of the acid concentration is possible.

The LiquiSonic® controller displays the measured values and in the event of deviations from reference values, a signal is sent to the control system. The measured values are stored in the controller and the clear trend view provides a quick overview of the process course. Through secure remote access options via the network and web server, the user can operate the controller from the PC at the workplace or via a tablet. The analyser is delivered as a plug and play system to guarantee simple and fast commissioning. Up to four sensors can be connected to one controller, which reduces the investment costs for several measuring points.