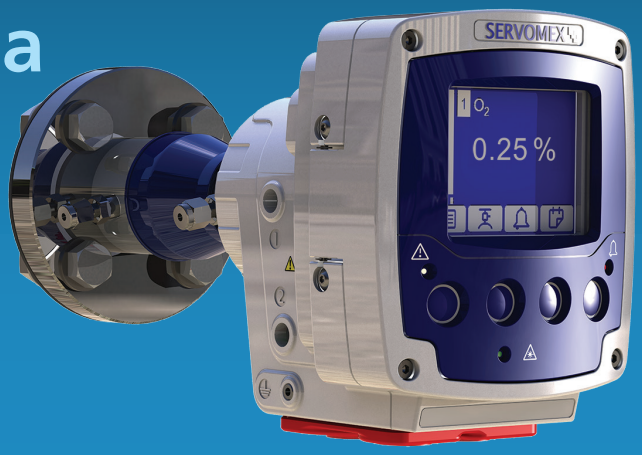
SERVOMEX

EXPERT PAPER

MiniLaser Ammonia

Utilizing the SERVOTOUGH MiniLaser Ammonia for the reduction of NOx emissions in combustion power plants.



Authors:
Dr Stephen Firth, Photometric Product Manager
Rhys Jenkins, Market Sector Manager, Servomex.

The effective reduction of NOx emissions in combustion processes is a key objective for meeting environmental legislation. A generic term for NO and NO_2 produced from the reaction of excess nitrogen and oxygen during combustion, especially at high temperatures, NOx is not only subject to legislative requirements for effective control on environmental grounds, but effective management also has important benefits for the effectiveness and efficiency of a combustion process.

In power plants and various other combustion processes waste NOx reduction, referred to as deNOx, is typically achieved by selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR). In SCR process, Ammonia (NH_3) is injected into the gas flow from the combustion process; this reacts with NOx in the flue gas, in the presence of a catalyst, to form H_2O and N_2. The SNCR process requires the introduction and mix of Ammonia or Urea with flue gases in a hotter environment with a temperature optimized to between 800° - 950°C. Temperature control is important in the process, as low temperatures can cause a surplus of unreacted NH_3, commonly referred to as Ammonia slip.

Typically measured downstream from the SCR catalyst unit or downstream of the NH_3 injection point for SNCR, the accurate measurement of Ammonia slip is of concern for the operation of deNOx plants for a number of reasons. In the first instance, high levels of unreacted NH_3 are both wasteful and costly for the plant operator. In power generation plants, Ammonia slip may also have important impacts on deposition and plugging of the catalyst, as well as potential corrosion of the air pre-heater located downstream of the SCR or SNCR process. In coal fired plants, excessive slip can impact NH_3 absorption and create fly ash with high levels of NH_3 which is then unsuitable for use as a mineral filler in asphalt control.

There are however some more positive benefits to monitoring Ammonia slip: The levels of slip helps indicate the proper function of the SCR/SNCR system and the NOx reduction process, enabling operations personnel to accurately predict when the catalyst has to be replaced.

It is difficult to control Ammonia slip without direct measurement, because many parameters influence the slip such as inlet NOx, fuel composition, and catalyst performance, while a carefully controlled Ammonia slip of < 2ppm is required to optimize the process. But despite the important operational, cost and safety benefits to measuring Ammonia slip, the measurement has been difficult to achieve with traditional extractive and Infra-Red analysis techniques.

The relative reactive nature of NH_3 means analyzer measurements are open to potential interference from a range of contaminants, including the presence of SO_2 or H_2O formed by the process and high levels of dust. While extractive systems traditionally measured Ammonia slip, the uncertainty of the measurement, combined with growing demand for ultra-low measurements requiring higher sensitivity and a faster response, meant extractive systems were increasingly unable to meet the demands of the process.

EXPERT PAPER: MiniLaser Ammonia

The measurement is difficult to achieve with traditional extractive and Infra-Red techniques, but by utilizing advanced Tunable Diode Laser (TDL) technology, such as that offered by the new SERVOTOUGH MiniLaser Ammonia gas monitor, presents a complete and effective solution for accurate Ammonia slip control.

Consisting of a tunable diode laser light source, transmitting optics, an optically accessible absorbing medium, receiving optics and detector, the TDL technology used in the MiniLaser Ammonia is suitable for in–situ cross stack measurements, with a typical system consisting of the laser emitter module and receiver mounted across the process pipe line or flue stack. The gas concentration information is held in the gas absorption line shape, which is obtained by scanning the laser wavelength over the specific absorption line. This causes a reduction of the measured signal intensity, which is detected by a photodiode and then used to determine the gas concentration: being a spectroscopic absorption measurement technique, TDL effectively counts molecules - or number density of molecules - that fall within the beam.

With the MiniLaser's TDL technology installed in-situ across the system, the NH_3-optimized measurement easily identifies Ammonia, enabling precise monitoring and subsequent control of NH_3 concentration below the requisite 2ppm.

As the cross duct installation gives an average reading rather than a point reading from an extractive sample, NH3 concentration levels can be measured with much greater certainty in the measurement. As the NH_3 sample never needs to leave the process, complications experienced with sample transports used in extractive methods are avoided, as well as contaminant problems posed by the dust, heat and water. This means not only is the measurement considerably more accurate, but plant operators avoid much of the downtime required for the calibration or cleaning of extractive systems.

The benefits of Servomex TDL technology make it a vital and beneficial measurement to add into power plant operations, with more than 300 Servomex units installed for this application worldwide. In addition, the revolutionary design of the MiniLaser make it ninety per cent smaller and eighty per cent lighter than many other comparable TDL analyzers. As a consequence, the MiniLaser's revolutionary compact size and dramatically reduced footprint offers unparalleled installation flexibility and a host of additional cost and performance benefits.

Instead of the time-intensive installation associated with traditional, bulky TDL analyzers, the MiniLaser can be installed quickly by just one person. Simple installation is supported by a new built-in display, which negates the need for using a laptop for configuration and diagnostics, while improved advanced optical performance achieves a wider acceptance angle. To ensure precision alignment from the outset, Servomex has also included a new mounting assembly for multi-direction adjustment. When combined with the new, quick-release mechanism, fast and accurate reinstallation - without the need for re-alignment - is achieved every time. The MiniLaser also includes Servomex's new purge design, which reduces nitrogen (N_2) and air purge costs by an impressive ninety per cent per annum; a significant return on investment when calculating lifetime operational costs.

Find out more about the new SERVOTOUGH MiniLaser Ammonia – contact your local Servomex Business Center using the details below or visit servomex.com/MiniLaser

NORTH AMERICA
Americas Business, Systems Engineering and Service Center
Tel: +1 281 295 5800
Email: americas_sales@servomex.com

ASIA PACIFIC
Asia Pacific Business, Systems Engineering and Service Centre
Tel: +86 (0)21 6489 7570
Email: asia_sales@servomex.com

EUROPE
European Business, Systems Engineering and Service Centre
Tel: +31 (0) 79 330 1580
Email: europe_sales@servomex.com

LATIN AMERICA
Latin America Business and Service Center
Tel: +55 11 5188 8166
Email: brazil_sales@servomex.com

INDIA
India Business, Systems Engineering and Service Centre
Tel: +91 22 3934 2700
Email: MEI_sales@servomex.com

MIDDLE EAST
Middle East Business Centre
Tel: +971 6552 8073
Email: MEI_sales@servomex.com

SERVOMEX
A MEASUREABLE ADVANTAGE