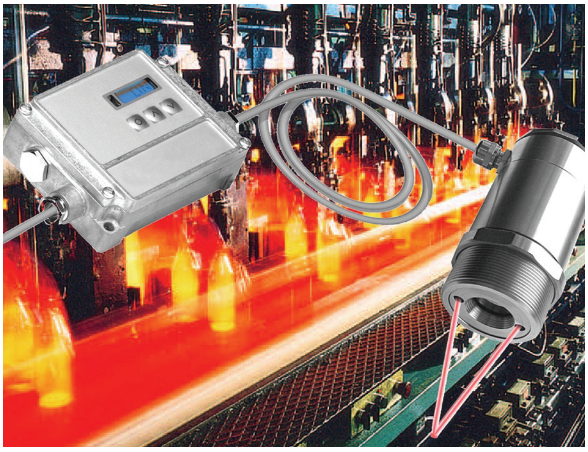
Sensors measure up in applications

Non-contact sensors from **Micro-Epsilon** are proving to be a useful technology in glass measurement applications and for research projects



The non-contact Optris CT glass infrared sensor

When it comes to taking measurements of such factors as temperature, pressure, force etc. non-contact sensors can prove to be an ideal solution. Micro-Epsilon is one company that develops a wide range of sensors for non-contact applications.

Recently, for instance, the company developed the Optris CT glass infrared thermometer which is, explains the company, suitable for measuring the temperature of glass products and surfaces during the production process, as well as glass substrates used in semiconductor processing and for the manufacture of solar cell panels.

The measurement of the temperature of glass is critical in glass production lines. One example of this is container glass production where it is necessary to obtain the temperature of the glass gob (molten glass that is poured into a blow mould) to observe the ratio between glass viscosity and gob weight. The mould temperature measurement is therefore critical for balancing the cooling levels of mould shells. Pharmaceuticals manufacturers also require temperature sensors to monitor and control the temperature of the glass when sterilising bottles.

Ulrich Kienitz, general manager at Micro-Epsilon Optris, goes on to explain that in the production of flat glass, automotive glass and construction glass, homogeneity of the complete glass panel is important, particularly when it comes to bending, annealing and tempering zones. The double laser aiming of the CT glass marks the real spot location and spot size up from 1mm at any distance. The 70:1 optics with selectable focus provide a very small spot size of just 1mm.

There are a number of features offered by the new sensor. It has an average measuring wavelength of 5.2µm to accurately measure temperatures from 100ºC up to 1650ºC of glass surfaces or products, including solar panels, flat glass lines, light bulbs, car glass finishing and glass containers. This wavelength is said to provide a low depth of penetration and enables reflection effects to occur for the infrared measurement of glass. Using shorter wavelengths than this would mean the sensor would measure through the glass, rather than measuring the true temperature of the glass itself. Of additional benefit, it also has a stainless steel sensor head and can be used in ambient temperatures up to 85ºC without cooling, and it has an automatic laser switch off at 50ºC to protect the laser aiming optics. The company is also offering a water-cooled version suitable for ambient temperatures up to 175ºC.

Research

Non-contact sensors are also proving ideal in a research application: Micro-Epsilon's non-contact, eddy current displacement sensors are being used on test rigs to help evaluate the leakage and pressure distribution for axial piston pumps and to analyse the dynamic behaviour of the barrel. This research could enable pump manufacturers to develop axial piston pumps with improved port geometry, therefore reducing overall noise and vibration levels of the pump, explains the company.

The research, which is being carried out by the Cardiff School of Engineering at Cardiff University, is concerned with the pressure distribution, leakage, force and torque between the barrel and the port plate of an axial piston pump.

The test rig required very accurate displacement sensors that could measure down to one tenth of a micron. So, for this application, three separate eddyNCDT (U05) sensors are being used on the test rig to measure the dynamic displacement of the barrel during motion, which rotates at around 1440rpm. These sensors, which have dimensions of 2mm diameter by 4mm in length (with a 0.5mm diameter sensor cable) are positioned on a 50mm radius around the port plate on the test rig, measuring to an accuracy of 0.1µm.

Commenting on the sensors, John Watton, head of research, said: "Each sensor calibration showed excellent linearity and produced calibration factors of 47.75µm/volt. The barrel dynamic displacement was measured at 180 bar and the results showed at least two waves superimposed, the main wave having a frequency of around 24Hz, which was the pump rotational frequency, and the frequency of the second wave being nine times that of the pump frequency."

The barrel dynamics were first evaluated by considering the torques generated by the fluid pressure between the barrel and the port plate, which required a complex solution of Reynolds equation of lubrication. Once the torques acting over the barrel swash plate system are known, the theoretical barrel dynamic motion can be calculated. Filtering of the higher frequency effects, typically 1kHz, showed a promising comparison between theory and measurement, explained Watton.

The results of the research, and other results on slipper leakage using the same sensors for slipper position, have been discussed with overseas pump manufacturers who are said to be 'more than a little interested in the findings'.

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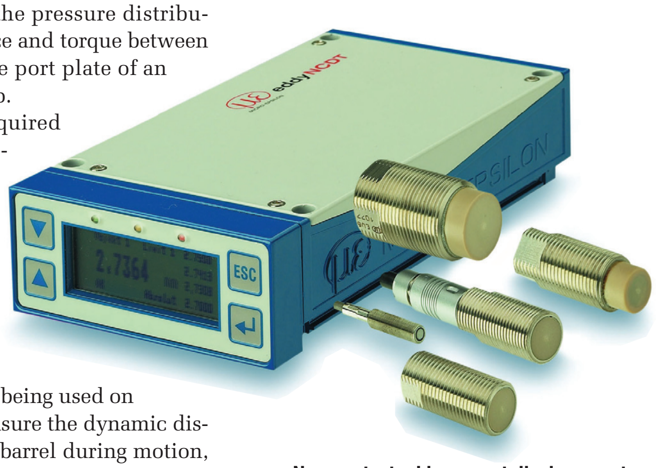

Non-contact eddy current displacement sensors are being used for research