Gems™
Sensors & Controls

Enhancing performance with pressure sensors

Pressure transducers have become an invaluable tool for the protection and optimisation of industrial equipment, converting fluid pressure into variable electrical signals that can monitor and control a system. Nevertheless, while existing transducers offer an impressive service, there is an ever-increasing level of accuracy in the output of these components, thanks to the new methods in which sensor elements and electronics packages are constructed. These new methods have not only added functionality to pressure transducers, they have enabled the components to withstand particularly aggressive process conditions, extremes of temperature, mechanical shock and vibration.

The latest pressure sensors from Gems Sensors and Controls combine an extremely sensitive pressure sensing mechanism with a sophisticated electronics package. They can respond to changes in pressure in 1ms or less, offer accuracy with almost zero drift over time and an operating life in excess of 100 million cycles. Their resilience and sophistication are the result of some highly innovative and carefully controlled methods of construction, in particular the advanced strain gauge technologies of sputtered thin film and chemical vapour deposition (CVD).

Pressure sensors contain a thin sealed sensing element or diaphragm that is in direct contact with the pressure media. Displacement of the diaphragm thus causes the strain gauge to flex, either in compression or under tension, with the electrical output being directly proportional to the pressure or vacuum applied. Output from the sensor is connected to onboard electronics, with the entire unit being contained in a compact and sealed stainless steel housing.

Strain gauge sensors, which contain this pressure sensitive diaphragm, can be effectively manufactured using the sputtered thin film process, in which a molecular layer of material is atomically fused to the beam or diaphragm. A solid target material is bombarded by energised particles, causing it to release atoms. The atoms that are subsequently released are deposited in a layer on a stainless steel beam to form the base insulating layer for the strain gauge; using the same process, the gauge is then coated with further layers of a suitable material, before being patterned using photoresist techniques.

The unwanted areas are removed by sputter etching to create a dielectrically isolated strain gauge in a conventional Wheatstone bridge arrangement, which is mounted on the reverse of a stainless steel diaphragm, resulting in a robust sensor that is suitable for direct contact with almost all liquids, oils and gases.

CVD is also highly effective in the manufacture of strain gauge sensors, which detect movement in a pressure diaphragm and convert the information into electrical signals. Devices manufactured via CVD are typically compact and extremely accurate with excellent hysteresis characteristics. The sensors are produced on wafers in large batches, using polysilicon deposited on a stainless steel substrate, with the strain gauge patterns being chemically milled.

Allied to these innovations in the chemical manufacture of pressure sensors have been some equally valuable advances in electronics, which have greatly enhanced the capabilities of transducers. For example, the electronic packages that have been supplied with pressure transducers over recent years have enabled each sensor to be tuned to meet the specific requirements of each customer. These packages incorporate advanced ASIC (application specific integrated circuits) technology, which enhance performance and functionality. They can also be customised, offering a convenient and effective option that cuts costs when expensive and complex control technology is not needed. Indeed, the economic advantage of introducing ASIC has been significant; combined with improvements in volume manufacturing techniques, the introduction of ASIC has, in many instances, reduced the unit cost of transducers by a factor of 10, enabling manufacturers to sell at an extremely cost-effective price.

CVD and sputtered thin film technology, combined with ASIC electronics packaging, offer a powerful combination of accuracy and reliability to the increasing number of engineers who choose to investigate the advantages of pressure transduction technology. The broad range of sensor products now available will enable engineers to apply transducers within ever more challenging environments, as will the modular nature of the components, which increases the number of options available when incorporating transducers. As they continue to develop and improve, pressure sensors will exercise a greater level of data acquisition and system control within the many industries that now employ them and within those that will adopt them in the future.

The 3500 Series

The 3500 series pressure transducer follows the highly successful 3100 and 3200 series transducers from Gems, bringing a versatile low pressure capability to the product line and opening up a host of new applications across medical and general industrial markets. Available in seven pressure ranges from 0-1 bar (0-15 PSI) to 0-16 bar (0-200 PSI), the 3500 series is characterized by its compact size, absolute, compound and gauge reference capability and its ability to operate over a wide temperature range of -40˚C to + 125˚C (-40F to 257F), which offers flexibility for a host of applications.

Proven MEMS (Micro-Electro-Mechanical Systems) technology provides high levels of performance and stability. Standard units have an accuracy of 0.25% full scale. The transducer is designed for more than 100 million FS cycles, with a long term drift of just 0.2% FS/ year, eliminating the need for costly recalibration.

Less than 45 mm long (1.77 inches) and weighing just 35 g (1.23oz), the compact construction of the 3500 makes it ideal for installation where space is at a premium. 316L stainless steel wetted parts and an all welded construction makes for a compact unit that is highly compatible to harsh chemicals and environments.

More complete specifications, dimensions and wiring diagrams for this sensor and other Gems pressure transducers are available at: **www.gemssensors.com**

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