European Metrology Research Programme

Delivering Impact

Faster vacuums = faster production

Vacuum chambers are an important tool during the manufacture of many high-tech and high-value products, such as semiconductors, photovoltaics and LED lighting. Fast, accurate pressure measurements play an important role in process control as product quality and process efficiency depend on how quickly and how consistently a vacuum can be applied. Improved vacuum measurements will support Europe's precision manufacturing industries to develop more cost effective products and processes.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

Semi-conductors are manufactured using precision instrumentation in a clean-room environment, as even a single speck of dust can lead to the failure of a high-value product. As components on semi-conductor processors get ever smaller and more sensitive to contamination, there is an increasing requirement to manufacture in a vacuum chamber – the ultimate clean-room.

The faster a high-quality vacuum can be established, the quicker manufacturing processes can begin, so faster cycling of air in and out of a vacuum chamber improves productivity. This not only requires accurate measurements of very low pressures at or near the vacuum, but also measurements of rapidly-changing pressures as air is pumped out. Until recently, vacuum measurement standards, used to calibrate industrial instrumentation, were only applicable in static pressure conditions, not the dynamic, rapidly-changing pressures used in high-value production processes.

Solution

The EMRP project *Vacuum metrology for production environments* developed a new vacuum gauge calibration facility capable of providing a well-defined rapid change in pressure, from 100 kPa down to 100 Pa in just 23 milliseconds. This exceeds even the most-demanding current industry requirements and is a huge technological advance. It is now possible, for the first time, to perform SI traceable dynamic pressure calibrations under conditions encountered by sensors in industrial applications.

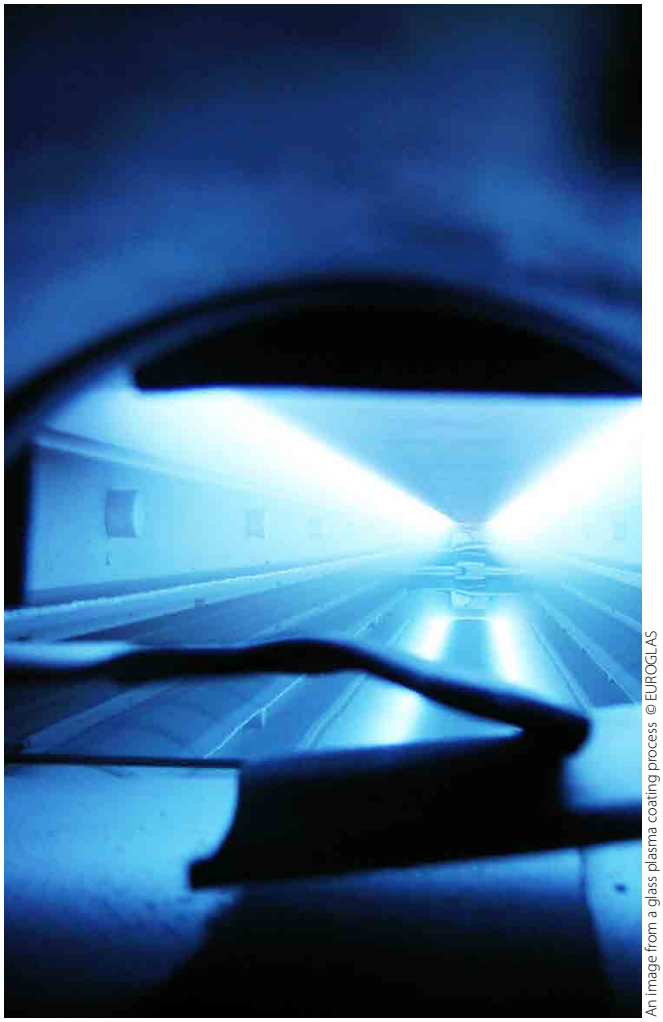
Impact

INFICON, a Swiss manufacturer of world-class instruments for gas analysis, used the new facility to test the prototype of its innovative new gauge for measuring dynamic pressure. The facility enabled INFICON to demonstrate the gauge's high-speed reaction to rapidly-changing pressures. INFICON's new Stripe™ High-speed Capacitance Diaphragm Gauge has a response time twenty times faster than the previous model and the facility validated the manufacturer's claim that it is the 'fastest gauge in the world'.

Access to the new facility helped accelerate the development of the new gauge and contributed to three patent applications. It is estimated that several million Euro in increased sales will result from the introduction of this new vacuum gauge. The fast-response gauge enables rapid analysis of vacuum chambers and will enable INFICON's customers in the semi-conductor sector to improve productivity by evacuating vacuum chambers effectively and quickly. This will lead to reduced time between production runs while continuing to ensure product quality. INFICON expects to extend the market for these fast pressure gauges to its customers in industrial vacuum coating and solar panel and display manufacturing.

Vacuum metrology for industry

The EMRP project *Vacuum metrology for production environments* developed and extended the metrology capabilities for low pressures and vacuum. Dynamic vacuum pressures, partial pressure and outgassing rate measurements can now be made traceable for the first time. This addresses the need for more accurate measurements in industrial settings to assess, for example, the quality of vacuums used in high-tech manufacturing processes, the sources of contamination of vacuums and leak identification.



An image from a glass plasma coating process © EUROGLAS

EMRP
European Metrology Research Programme
Programme of EURAMET

The EMRP is jointly funded by the EMRP participating countries within EURAMET and the European Union

www.euramet.org/project-IND12

Karl Jousten
PTB, Germany
+49 309 481 7262 | karl.jousten@ptb.de

11326/0916 - IND12 14094